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MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS.

The second annual meeting of the Association of American Geographers was held in this city on December 26 and 27, 1905. The facilities of the house of the American Geographical Society were placed at the service of the Association: About forty members and invited speakers participated in the four sessions. The occasion was much enjoyed both as a social reunion and as offering an interesting programme in which the several phases of geography—particularly the organic, physiographic, and educational—were well represented. The meeting was under the presidency of Professor W. M. Davis, of Harvard University.

The American Geographical Society served luncheon to the members on both days of the meeting. The annual dinner took place at the Hotel Endicott on the evening of December 26.

Many of the papers were illustrated by lantern views. The following papers, unless otherwise indicated, were read by their authors:

W. M. Davis (President's Address). An Inductive Study of the Content of Geography.

A. H. Brooks. The Influence of Geography on the Exploration and Settlement of Alaska (illustrated).

J. Walter Fewkes. The Sun's Influence on the Orientation of Hopi Pueblos (illustrated with diagrams).

Martha Krug Genthe. Valley Towns of Connecticut. (This paper will be printed in full hereafter in the BULLETIN.)

E. O. Hovey. Geographical Notes on the Western Sierra Madre of Chihuahua (illustrated).

A. P. Brigham. Lake Loen (Norway) Landslip of January, 1905 (illustrated).

Emory R. Johnson. Political Geography as a University Subject.

Cyrus C. Adams. Map Making in the United States.

Cleveland Abbe. The Importance of sustaining a special journal of Geophysics in the English language, as representing the highest development of Geography (read by title).

Cleveland Abbe. A Modified Polar Projection adapted to Dynamic Studies in Meteorology.

L. A. Bauer. The Magnetic Survey of Oceanic Areas (read by title).

Isaiah Bowman. Hogarth's "The Nearer East" in Regional Geography.

R. M. Brown. Notes on the Mississippi River Flood of 1903 and on the floods of other years.

Henry G. Bryant. Notes on Some Results from a Drift Cask experiment (illustrated).

M. R. Campbell. The Santa Fe peneplain (read by title).

G. C. Curtis. Glacial Erosion in the New Zealand Alps (Summary by President Davis).

W. M. Davis. Physiographic Notes on South Africa.

N. M. Fenneman. An example of Floodplains produced without floods.

R. T. Hill. The Geographic Origin, History and Decadence of the Mexican Plateau, with a definition and description of the Western Sierra Madre (read by title).

E. Huntington. Border Belts of the Tarim Basin, Central Asia (letters presented by President Davis).

D. W. Johnson. Drainage Modifications in the South Eastern Appalachians (illustrated).

William Libbey. Physical Geography of the Jordan Valley (illustrated).

Lawrence Martin. Observations along the Front of the Rocky Mountains in Montana.

A. Lawrence Rotch. Proofs of the Existence of the Upper Anti-Trades (illustrated).

R. S. Tarr and Lawrence Martin. Observations on the Glaciers and Glaciation of Yakutat Bay, Alaska (illustrated).

Cleveland Abbe. The Present Condition, in our schools and colleges, of the study of Climatology as a branch of Geography; and of the study of Meteorology as a branch of Physics.

R. E. Dodge. The Organization of School Geography (read by title).

Martha Krug Genthe. Some remarks on the Use of Topographic Maps in the schools (illustrated).

J. Paul Goode. Commercial Geography for Secondary Schools (read by title).

F. P. Gulliver. Home Geography.

D. W. Johnson. Map Studies for engineering students: the classification of contour maps on a physiographic basis (illustrated).

J. Russell Smith. The Place of Economic Geography in Education.

P. S. Smith. Practical Exercises in Physical Geography.

As the Association has not yet provided for the regular publication of its proceedings, the offer of the American Geographical Society to devote all of the February number of the BULLETIN that was needed adequately to present the papers and abstracts was accepted. Special effort has been made by the authors, in preparing abstracts of papers, fully to include all the more important features.

In opening the pages of the BULLETIN to this extended report, the Society believes that it is presenting material which will be both interesting and valuable to geographers.

The officers of the Association elected for 1906 are as follows: President, Cyrus C. Adams; First Vice-President, Angelo Heilprin; Second Vice-President, William Libbey; Secretary and Treasurer, Albert P. Brigham; Councillors—W. M. Davis (three years), I. C. Russell (two years), H. C. Cowles (one year).

PAPERS AND ABSTRACTS.

AN INDUCTIVE STUDY OF THE CONTENT OF GEOGRAPHY.

BY W. M. DAVIS (Cambridge, Mass.).

(Presidential Address at the Second Meeting of the Association of American Geographers, December, 1905.)

The Need of Comparing Opinions.—One of the objects to which this Association may well direct its attention is the nature of the whole subject of Geography, under whose broad shelter our individual studies are carried on. If we work only in view of our chosen field within the whole area of geography, we lose something of breadth, although we may gain much in depth. Our work will become more serviceable to others if it is presented in such a manner that its relations to the whole subject are made clear. Not only so; we may often benefit ourselves by systematically setting forth the place of our individual studies in geography as a whole, for we may be thereby led to discover that the systematic sequence of parts is interrupted here and there by gaps, which can be filled by well-directed effort. We should, I think, all profit if in the presentation of papers at these meetings some attention were given to an exposition of the speaker's ideas concerning the part that his topic occupies in the whole subject; we should thus better appreciate our relations to each other; and this I hold to be important, for one of the manifest difficulties ahead of us is the possible lack of natural association and coherence between such topics as magnetic surveys of the ocean, the distribution of certain kinds of toads, and the deserts of eastern Persia.

But it is manifest that, if we should attempt to make exposition of our ideas concerning the relation of our own studies to the whole subject, we must have previously gained a tolerably definite idea of the nature of the whole. Very likely we each have some such conception. If so, it would be profitable to institute a collection and a comparison of opinions; though it can hardly be doubted that they would show much diversity.

Examples of Geographical Statements.—As a contribution towards such a collection of opinions, I propose to consider the nature or content of geography in this address; but instead of presenting an abstract definition of the subject, the problem will be regarded from the other side. There will first be presented a number of sample statements that are presumed to be geographical because

they are taken from geographical works; these statements will then be analysed in order to discover their essential nature; finally, an attempt will be made to discover the nature of the whole subject of geography on the basis of the statements thus analysed—that is, to discover the content of geography on the basis of an inductive study. The statements to be presented are taken from a variety of sources—text-books, treatises, and journals; they are often condensed from the original.

Here, for example, is a first set of items or statements: There are three native states in the Himalaya which are independent of British rule. The rivers of southern Gascony flow in radiating courses. There are more than 300 asteroids. The average man has about 87 cubic inches of brain. The mean depth of the ocean is about two miles. A new map of France on a scale of 1:50,000 is in course of publication. Protozoa are the simplest forms of animals, consisting of a single cell. The magnetic poles do not coincide with the poles of rotation. Celtic is spoken in Wales, the Highlands of Scotland, and western Ireland. Cotton is produced in the southern United States. The fall of rivers is usually greatest in their upper courses. The Grand Duchy of Prussia became a kingdom in 1701. Cryptogams are flowerless plants. The Hindu-kush, the highest mountains of Persia, trend to the northeast. Australia has many marsupials, of which the kangaroo is the largest. Amundsen has successfully made the Northwest Passage.

If all these statements are truly of geographical quality, it follows that all similar statements would be of geographical quality also. We should then have, in a complete geography, accounts of all states, in the Himalaya or elsewhere, dependent or independent of British or of other rule; descriptions of the course of rivers in all parts of the world; additional facts about other bodies in the heavens besides the asteroids; accounts of man's other organs than his brain; details as well as averages of ocean depths; descriptions of multicellular as well as of unicellular animals, and of flowering as well as of flowerless plants; reports on old as well as on new maps of France and of all other countries, whatever their scale; other items concerning terrestrial magnetism as well as the position of the magnetic poles; reports of all sorts of voyages; accounts of the changes of all duchies to kingdoms or of kingdoms to duchies, and of other political changes as well; mention of the animals of other lands than Australia, and the products of other countries than our southern States; announcements of voyages in all parts of the world in all centuries.

The Complexity of Geography.—The first impression about so varied a collection of statements would be that the subject under which they are all properly included must be a sort of *omnium gatherum,* without any well-defined unity of substance. Such, indeed, geography has been thought to be by some critics. A closer examination of our materials must be made to see if we really have to do with a heterogeneous collection of incoherent facts, without continuity of thought or unity of discipline. It may be that some of the items above cited do not justly belong under geography, and that an enchainment not apparent at first may be found to bring the remaining items and their proper fellows into some systematic association.

On reviewing the statements given above it appears that some are concerned with matters remote from the earth and commonly associated with astronomy; that some are concerned with matters of a personal or technical nature; that a third group of statements contains accounts of inorganic features of the earth; and a fourth group of organic inhabitants of the earth. Let us examine these several classes to see in how far they may be justly considered geographical.

Excepting as an astronomical statement is found to be related to terrestrial matters in such a way as to throw light on them, it should not be considered directly or indirectly geographical, in spite of the mention of such a matter in a geographical text-book; for by common consent geography has to do primarily with the earth. Hence the mere statement of the number of asteroids should be excluded from our consideration. It may, however, be advisable to retain in elementary text-books certain statements concerning planets in so far as they serve to emphasize the globular form of the earth by showing that there are other bodies like it; and such mention of the sun and moon as is needed for the understanding of insolation in relation to climate and of gravitation in relation to tides; and such account of the stars as shall serve in the proof of the rotation of the earth and in the determination of the attitude of its axis. Nevertheless all of these items seem to be only indirectly associated with our subject; they do not aid us to discover the real nature of geography.

Technical and personal items may naturally be associated with geography, if the things and events with which they are concerned are of a geographical quality, as maps and explorations certainly are. The announcement of the publication of a new map or of the completion of a remarkable voyage is therefore a piece of appropriate geographical news. Accounts of old maps, of old voyages,

and of old ideas are very illuminating in showing how the geography of to-day has been developed; but they belong more with history than with geography when presented in order of time.

Non-Geographical Statements.—Many of the statements under the two remaining classes, which concern inorganic and organic matters on the earth, are properly geographical, if we judge by the repeated occurrence of such statements in many geographical works. Yet we cannot believe that all statements about inorganic and organic matters on the earth belong under geography. It is easy to instance a number of such statements from geographical sources which can hardly be regarded as having any clear association with geography. Consider, for example, the following set of items, all taken from geographical text-books:

The gastrula stage occurs just before maturity in the sponge. All substances transmit electrical energy. Crystallization is explained by supposing that the cohesive force of molecules is not exerted equally on all sides. After 1810 several independent republics were formed in South America. The rosaceæ have regular flowers.

However interesting and useful these items of information may be, they can hardly be regarded as geographical, even under the very broadest interpretation of our subject. They have probably been added to the text-books from which they are quoted in the belief that they are worth knowing, and that the pupils in our schools will have little chance of learning them if they are not brought in under the popular subject of geography. I question the advisability of such a method of promoting popular education; but that is another story. Our problem is to distinguish these and many similar statements from a large variety of other statements concerning the inorganic and organic terrestrial matters, so as to know which ones are properly of geographical quality and which ones are not.

Statements involving Relations.—The best solution that I have been able to find for this problem comes from a consideration of such statements as are included in the following third set of extracts, which, like the other two, have been taken from geographical sources:

The people of the Dalmatian coast are largely engaged as fishermen on the Adriatic; here the Austrian navy obtains its best seamen. A number of gulfs and mountain ranges naturally divide the people of Europe into groups or nations. Some parts of Bengal are so favoured with rivers that almost every cottage has a navigable

stream at its door, and the Bengalese farmer keeps his boat just as the English farmer keeps his gig. Northern Uganda is drier, rain often fails, grass is short, and dry-country animals, such as zebras and ostriches, abound. The level land near Lake Titicaca is of small extent, and is occupied by alkaline marshes subject to overflow; for this reason the Indians cultivate the slopes in preference, converting them into narrow terraced garden beds. The periodic or monsoon winds that blow alternately in one direction and the other along certain coasts, as between India and East Africa, have long been favourable to navigation and trade. In northwest France the farmhouses on the chalk uplands are gathered into compact villages around one or more deep wells, because the ground water there is deep below the surface and difficult to obtain; but in the valleys the houses are scattered, because each family can easily procure its own water supply with little trouble.

Geography, a Study of Relations.—These statements differ from some of those of the two earlier groups of citations, in that they each contain at least two kinds of elements, one of which stands in a more or less distinctly causal relation to the other. The statements vary, in that some of the relations suggested are relatively simple while others are more complex; and in that some statements are rather empirical while others are more fully explanatory; but they are all alike, in that they involve a relation of cause and effect, usually between some element of inorganic control and some element of organic response. As such, these statements are examples of the most generally treated material that I can find; and hence I am disposed to say that any statement is of geographical quality if it contains a reasonable relation between some inorganic element of the earth on which we live, acting as a control, and some fact concerning the existence or growth or behaviour or distribution of the earth's organic inhabitants, serving as a response; more briefly, some relation between an element of inorganic control and of organic response. The geographical quality of such a relation is all the more marked if the statement is presented in an explanatory form. There is, indeed, in this idea of a causal or explanatory relationship the most definite, if not the only, unifying principle that I can find in geography. All the more reason, then, that the principle should be recognized and acted upon by those who have the fuller development of geographical science at heart.

Geography as the Study of Location or of Distribution.—There still exists in some quarters a tendency to limit geography by definition to the study of location, leaving the study of all the things that

are located to other subjects. There is so little support for this narrow view of the subject to be found in modern geographical books that it need not be further considered. Another and more widely-accepted definition treats geography as the science of distribution. This is particularly a British view of the subject, and at least one British geographer urges that the distributed things should not be regarded as belonging to geography at all; but his writings are broader than his definition. While location and distribution must always be important elements of geography, all geographical books give much attention to the nature of the things that are distributed, and all recent books give much weight to the relations in which the distributed things occur: hence relationship seems to me the primary principle of the two, and distribution takes a secondary rank. The thing must be known before its distribution can be serviceably studied. The division of the peoples of Europe into groups or nations in consequence of the division of Europe by gulfs and mountain ranges is a geographical relation, in which the unlikeness of the things distributed takes precedence of their distribution.

Indeed, if geography is only the science of distribution—that is, the regional aspect of other subjects—it would be hardly worth while to maintain the study of geography apart from that of the subjects whose regional aspect it considers. Moreover, if geography is defined simply as the science of distribution, then the distribution of anything at all is a fit subject for geographical study. Under such a definition the distribution of hypersthene andesite or of books of poetry would be part of our responsibility; but there is nowhere any indication that geographers feel responsible for the distribution of such things. Again, if distribution is given first rank, the regional or spacial occurrence of all sorts of things is thereby given so great an importance that an insufficient place would be left for the systematic consideration of geographical things; yet most books first present things of a kind together—that is, they present the subject systematically—before they take up the distributional or regional treatment of different kinds of things.

As a matter of fact, nearly every example that is presented in this essay as an example of a geographical relation might, if desired, be presented as an example of distribution; and nearly all statements of distribution may be turned around so that they shall enter into or constitute relations; hence the total content of geography would be much the same under either principle. The relations that could not be presented under the lead of distribution are

those which are the same everywhere; but it seems to me rather arbitrary to include relations that vary from place to place, and to exclude relations that are world-wide in their uniform occurrence. For example, the composition of the atmosphere or of the ocean, always accepted as an appropriate matter for mention in elementary texts, deserves no place in geography, treated as the science of distribution, until the minute variations of composition from place to place are considered.

In any case, location and distribution are fundamental elements of geography, and maps of the lands and charts of the oceans are essential in its every chapter. In view of the importance of these elements, some are disposed to attach an undue value to surveying as a part of geography. But surveying properly belongs in geography about where writing belongs in literature; and if it is given higher rank the student may, by misfortune, turn his chief attention to the art of mapping instead of to a study of the things that are mapped.

Physiography and Ontography.—If the principle of explanatory relationship be adopted as a general guide to the content of geography, it follows that neither the inorganic nor the organic elements which enter into geographical relations are by themselves of a completely geographical quality; they gain that quality only when two or more of them are coupled in a relation of cause and effect, at least one element in the chain of causation being inorganic and one organic. When they are considered separately, but as if in preparation for an understanding of the causal relations in which they will be later presented in the study of geography proper, they may be considered sub-geographic; and then the inorganic elements may be called physico-geographic or physiographic; and the organic elements may be called ontographic. Common usage recognizes the first of these divisions, but not the second, as we shall see later. It is well to emphasize the clause, "as if in preparation for an understanding of the causal relations in which they will later be presented in the study of geography proper;" for many items which, under this proviso, are of physiographic or of ontographic quality, may under another proviso belong in other departments of knowledge.

Physiographic Matters.—This may be made plainer by citing particular cases in which a number of different topics, familiar from their occurrence in books on geography, will be seen to fall under other subjects when they enter into non-geographical relations. For example, the size and rotation of the earth and the

general movements of the tides are undoubtedly physiographic elements, yet both may be treated appropriately under astronomy when they are considered in their relations to other planets. Sea-water, when regarded as a liquid compound which holds various salts in solution, may be studied properly by the chemist with regard to its composition; nevertheless sea-water, as the medium in which organic forms live, is an indispensable subject for physiographic inquiry. The horizontal strata of plateaus are a fit topic for geological investigation, as regards their origin and history; but they are no less a subject for physiographic investigation as affecting present form. It, therefore, seems impossible to determine, merely by a consideration of the thing studied, whether it belongs to physiography or not.

A given object may belong under several different sciences, and may be treated in text-books on different subjects; it is the relation into which the object enters that determines its place.

There are, however, certain inorganic topics, commonly found in geographical books, which seldom, if ever, enter into relations with organic topics, and which would, therefore, under the strict application of the principle of relationships, be ruled out of physiography, and thus out of geography also. Such are cirrus clouds and haloes, the crevasses and blue veins of glaciers, and the polar flattening of the earth. Nevertheless, most or all of these topics will probably hold their places in books on physiography, because they serve to complete the picture of the whole earth as the home of life. In any case, little is gained by a very strict or over-logical application of a useful principle of classification in a problem such as we are considering.

Ontographic Matters.—The determination of the science under which a thing belongs by means of the relations into which the thing enters is an even more important guide in ontography than in physiography. For example, one may read in a certain text-book of geography that all forms of life consume food. In so far as the assimilation of food and the organs by which it is accomplished are concerned, the consumption of food belongs under physiology; but the consumption of food is an ontographic matter in so far as it brings an organism into contact with the rest of the world and thus causes it to enter into geographical relations.* Commercial geo-

* As thus defined, ontography is more narrowly limited than in my paper on "A Scheme of Geography" in the Geographical Journal for October, 1903, where it was made practically to include the relations or responses which responding organisms enter into with their inorganic controls. Defined in that way, ontography is too nearly identical with biogeography, or, indeed, with geography. As here limited, ontography is not the study of the organic response, which is practically equivalent with the geographical relation itself; it is simply the study of the organic act or deed or motive which results in a response or relation when a physiographic control is encountered.

graphy is largely concerned with relations that grow out of this element of ontography. Water is essential in organic processes of many kinds. This is, again, a physiological matter, if it is examined with reference to the processes of circulation; but it is ontographic when it is found to lead to a relation with the sources of water supply; villages gathered around deep wells on the chalk uplands of northwestern France are examples of the geographic relation thus brought about.

Plants and animals tend to diffuse themselves or to be diffused over the earth. This is a fundamental fact, usually associated with the study of biology; but the limits of diffusion and in many cases the means of diffusion are determined by physiographic controls, hence the tendency to diffusion is an ontographic matter.

The need experienced by all forms of life to secure food, already instanced, leads to many other relations than those of commercial geography. The need of food is satisfied without going in search of it if the food is contained in a moving medium that surrounds the organism; hence those organisms that live chiefly upon food contained in one or the other of the two great mobile envelopes of the earth, the atmosphere or the hydrosphere, are often rooted or fixed: the air or water currents carry the needed food to the waiting plant or animal—and this is surely too important a geographical relation to be omitted from a broad consideration of our subject. Other organisms take advantage of the currents of air or water to be passively carried about by them, taking their food when they happen to come upon it. If they are land-dwellers, they are so small that they can easily be wafted about by the winds; if they are dwellers in water, they may gain greater size by assuming about the same specific gravity as that denser medium, so as to float easily in its perpetual currents*. Still a third class of organisms move of their own volition; and in connection with these there are all manner of geographic relations. Some of them involve the development of wings, whereby motion can be effected in the comparatively unsustaining air, as in the case of many insects and birds, of a few mammals, and formerly of some reptiles; some involve the development of fins to produce motion in the sustaining water. These examples are as good illustrations of organic responses to inorganic controls as are the canoes and the steamships of uncivilized and of civilized man.

* If the substance of this relation were treated under the principle of distribution, it could be presented as follows: Organic forms that have no means of locomotion of their own, but depend on a moving medium for their transportation, are of unlike size, according as they occur on the lands or in the ocean. If they inhabit the lands they are of minute, even of microscopic size, so that they may be carried about by the winds of the unsustaining air; they may be of larger size if they inhabit the ocean, for there they so closely imitate the specific gravity of the water that they float about with its perpetual currents.

It follows from the preceding paragraph that the more closely our standard geographical material is examined, the more clearly it appears that its ontographic as well as its physiographic elements may fall into other sciences when they are treated in other relations; and that they become most distinctly geographic when they enter into the causal relations of the kind set forth above. The rise and fall of the tides is a physiographic matter when it is seen to determine the distribution of certain forms of life, such as barnacles, or to influence the availability of harbours for the entrance of shipping; the occurrence of coal is a physiographic matter when it is found to influence the industry of a district and the commerce between nations; the small size of spores, pollen, and germs is an ontographic matter when it is seen to be related to their transportation by the thin air; the sensitiveness of organisms to temperature changes is an ontographic matter when it is shown to affect the distribution of plants and animals over the earth. Yet all these matters may be treated with entire justice under other sciences than geography. It is, therefore, to my reading, of capital importance in determining whether a statement is of geographical or sub-geographical nature to know how far it constitutes or enters into causal relations of the kinds that have been here considered.

Is Ontography a Part of Geography?—It is perfectly true that many of the illustrations just given are not commonly regarded as belonging under geography; but it seems to me that their exclusion is illogical and arbitrary. They are practically all to be found in certain standard geographical works, and many more might be taken from such books as Ratzel's Anthropogeographie and Beddard's Zoogeography. The general principle by which one should be guided in determining the relevancy of such matters is as follows: If a certain relation between an inorganic control and a responding organism is a geographic relation, then all similar relations are also geographic. For example, a well-known text-book makes the statement that water-plants are supported by the relatively dense medium in which they grow, and hence do not need strong woody stalks such as many land-plants have. This is an excellent example of a geographical fact: it involves a relation between an organic growth and an inorganic medium.* But the flight of birds, the small size of germs, the essential agreement between the specific gravity of fish and of water, the universal habit of breathing

* If stated in terms of distribution, this might be phrased as follows: Plants with stems and branches strong enough to support their own weight grow on the lands, where the air is too light to buoy them up; plants with weak stems grow mostly in the sea, where they are held up by the heavy water.

oxygen, all involve similar relations. The first example seems to me undeniably geographic; the others are no less so. To exclude the latter from geography while including the former would be to set very arbitrary limits to our subject.

It may, perhaps, be objected that flight and breathing are processes of too ancient origin to be considered as geographical; but inasmuch as they are maintained into the present time, by inheritance through persistent conditions of environment, they have the same right to a place under geography as is enjoyed by such examples as the prevalence of the fishing industry on the Dalmatian coast, or the custom of the French farmers on the chalk uplands of living in compact villages; for these habits, also, are not independently originated by each man who follows them, but are continued by inheritance through persistent conditions of environment.

There are certain matters, frequently encountered in text-books of physical geography, which belong better, as it seems to me, under ontographic relations. Such are the distribution of plants and animals, and the races of man. The association of such topics with physical geography is probably the result of conceiving all the rest of the subject as contained under political geography. The contrast of physical with political conditions may serve well enough in elementary books, where the distribution and behaviour of man are the chief subjects in political geography, and where plants and animals are therefore thrown in with physical geography; but in the more advanced and general treatment of the subject such an arrangement is not satisfactory. It does, however, seem legitimate to introduce as often as desired ontographic responses in a physiographic text, in order to show at once the kind of response that certain controls call forth, and thus to impress the fact that the physiographic items are really related to ontographic items: a similar introduction of physiographic items is appropriate in chapters on ontography. This practice is followed by certain writers.

There are three definite positions and many indefinite positions that might be taken with respect to the attention that should be given by geographers to organic considerations. The narrowest position limits geography almost entirely to the inorganic features of the earth—that is, to physical geography or physiography. This is the view of geography held by some historians, who take unto themselves practically all the human element that is so commonly encountered in political geography. An intermediate position would include physiography and the more manifest relations into which it enters with various forms of life, and particularly with man, but

would not accept responsibility as to the less manifest responses of various living things. This seems to be the position taken by many geographers, more or less consciously. The third position would treat ontography as thoroughly as physiography, and would search for all the geographic relations of physiographic controls and ontographic responses. This is certainly the broadest of the three positions, being, as many would feel, too broad, and involving too much overlapping upon other subjects. For my own part, there seems to be so manifest a necessity of gaining a responsible knowledge of ontography, at least of elementary ontography, before geography proper can be successfully treated, that ontography should come to be regarded as a part of it. The analytical and inductive methods of this paper, therefore, lead me to adopt the third position; and I believe that this position is essentially consistent with the opinion of writers who, like Ratzel and Reclus, have cultivated the most advanced or matured stage of geographical science.

The Importance of Explanatory Relations.—Although various facts which may make parts of relations between inorganic controls and organic responses, or which are met with in preparation for an understanding of such relations, thereby gain a most characteristic geographical flavor, a very brief review of geographical books will suffice to show that many statements there included do not explicitly possess this flavor. In the first place, in the older books the idea of relationship had no distinct recognition. That was the time of memorized names of capes, of empty boundaries, of unexplained lists of products. Almost anything about the earth or its inhabitants was then accepted if it reached a satisfactory degree of what is called "importance." In the newer books, the principle of explanatory relationship is very generally acted upon; there are, nevertheless, many relations stated so empirically that the pupil may fail to gain them a full appreciation of the best essence of geography. Consider, for example, the following statement from a good text-book: Some form of Celtic is spoken in Wales, the Highlands of Scotland, and western Ireland. This is nothing more than an empirical statement of a fact of distribution. Many a student might memorize such an item without gaining any clear insight into its geographical meaning. The real point is that the early inhabitants of Great Britain, being attacked by invaders from the continent on the east, survived only where pursuit was difficult, as in the rough ground of Wales, in the rough and distant ground of the Highlands, or in the distant and isolated ground of Ireland;

and hence only there the early language is still preserved. The fact that Celtic, as Celtic, is spoken in certain parts of Great Britain belongs to philology as well as to any other subject; the fact that Celtic is the language that was once spoken generally through Great Britain might come under history as well as under any other subject; but the fact that Celtic is still spoken in rough, distant, or isolated parts of Great Britain, because of their roughness, distance, or isolation, is a local example of an important class of relations between controls and responses, and as such it belongs distinctly under rational geography.

The Expansion of Geography.—Geography has still much progress to make. There is not only much to be done in the way of exploration of little-known lands and seas, but many of the more civilized countries still merit closer study than they have yet received, if we may judge by the notable incompleteness of the best handbooks and treatises. One method of carrying the subject forward consists in outdoor observation; and this method cannot be too highly recommended to those who wish to contribute to the fuller development of our subject. When we realize that we have no modern and maturely-developed account of the geography of such a state as Virginia, or Ohio, or Colorado, or California, it becomes evident that abundant opportunity for exploration lies near at home. But there is a second method by which geography may be promoted —that is, by thinking about what we see, and thus expanding every example of a geographical relation that we find to its farthest legitimate extension. Take, for example, the common case of a road which runs through a notch in a high ridge; such a detail of location is a response of the ontographic element, movement, to the physiographic control, gravity; hence all such responses to gravity should be searched out so that they may be systematically treated as to kind, and regionally treated as to distribution. Such matters are surely as properly of a geographical quality as are various responses to sunshine which are always found among the standard matters of our books. How many more responses to the universal and persistent force of gravity there may be, we do not yet know. Again, take such an example as that afforded by the habit of working by day and summer and resting by night and winter. These are responses to the controls of light and heat in contrast to darkness and cold, which result from the illumination and warmth of the rotating and revolving earth by an external sun. This suggests that all other responses to light and to darkness should be sought out and studied; for it leaves the limitations of our subject very vague if we make a

beginning with such relations and do not carry them to an end; it makes the limitations very arbitrary if we make a beginning of such relations and stop with the first or the second or the third example, instead of pressing on to the very last.

It is an application of this same principle that makes it impossible to limit the organic side of geography to man; for the habits which man has developed in his search for food, clothing, shelter, and so on are in very many ways closely analogous to those developed by animals in a similar search. In the same way the sensitiveness of man and animals to climatic conditions by which limits of distribution are so largely determined is paralleled by the sensitiveness of plants to similar conditions. Life is a unit; if one form of life comes under the study of geography because it responds to physiographic controls, then all forms of life come under geography.

The expansion of geography through time is likewise inevitable, unless it is most arbitrarily limited to the "present day." Precisely the same principles have been embodied in the relations between physiographic and ontographic elements in the past as are embodied in them now. It is, therefore, most illogical to think of geography as a science that deals only with to-day. There has always been a geography, all through the geological ages; geology is the integration of all its momentary or geographical differentials. We may never know very much about the successive geographies of the past; but all the fragments that have thus far been learned assure us that it was of essentially the same order as the geography of the present. The recognition of this principle is of the greatest importance to geography and to geology as well.

The Subdivisions of Geography.—It is but natural that the different phases of human geography should have been more fully developed than the other branches of our science. Political geography, frequently overrunning civics, economics and history, has long been familiar as an elementary subject; but with us it has seldom been carried into the higher reaches of education. Commercial geography is rapidly gaining an important place in our schools, and is meeting the danger of becoming almost as empirical as the old-time lists of products of the several States. Biogeography has several parts. Anthropogeography, as expanded by Ratzel, seems destined to become an important subject in the universities, because of the greater insight that one gains through it into history. Zoogeography and phytogeography are, in my opinion, as a rule, too strictly limited to facts of distribution alone; these

divisions of the subject should be expanded so as to include for animals and plants a consideration of what would correspond to the political and commercial geography of man. Paleogeography is occasionally treated, but it must always be a fragmentary subject, because it is based on fragmentary records; it will, however, be better treated by geologists in proportion as they have had geographical training.

The growth of explanatory treatment, which makes so characteristic a difference between the content of geography in books of a hundred years ago and of to-day, is chiefly due to the different amounts of general knowledge in stock then and now, and consequently to the different philosophies then and now prevailing. The subject has thus gained greatly in strength, in disciplinary value and in living interest. At the same time, geography has come to cultivate more and more—some would say, to trespass more and more—upon the fields that are also cultivated by other subjects. If the trade-winds are not simply described as to region of occurrence, direction of blowing, weather conditions therein prevailing, and so on, but are also explained as parts of an extensive convectional circulation between equator and poles, modified by the deflective effect of the earth's rotation, all this explanatory matter has a strong flavor of physics. If the occurrence of plants of a certain kind in a given region is not merely asserted, but is shown to be the result of climatic conditions to which the plant responds owing to its sensitiveness to temperature and moisture, this closely resembles certain chapters of botany, and the same may be said regarding the relation of animal distribution to zoology. If the boundary of a state, the location of a city, or the industry of a district is rationally explained instead of empirically stated, the explanation is of a kind likely to be found in books on history and economics. Shall we, then, in view of this, relinquish explanatory treatment to other subjects and content ourselves with empirical statements? Shall we adopt the limitation to the location of things, as above suggested, and thus avoid duplication with other subjects? No. Duplication is unavoidable; and, moreover, it is reciprocal. The historian, as well as the botanist and the zoologist, must borrow from the geographer all manner of facts regarding location, extent, distribution, climate, form, movements, products, populations, and so on; the geologist can hardly make a step into the realm of the past without having made preparatory study of the present. Overlapping and duplication are unavoidable. We must each of us try as far as possible to concentrate upon his own subject; but we must at the

same time borrow and quote with the utmost freedom from any other subject that will give us aid in the consideration of our own.

Examples of Helpful Duplication.—One of the most interesting fields that I have run across in geographical research is that open common where geography and philology overlap. It has often been remarked that the Arabs of the desert have many terms for sand dunes, evidently because they are familiar with the many forms that sand dunes there assume; their language has developed in a peculiar direction as an ontographic response to their peculiar physiographic environment. In the same way, the people of the Alps have various terms by which to name mountain summits of different shapes; this is another ontographic response to a peculiar physiographic environment. But there are other less manifest examples of a somewhat different kind. We treasure as a fine geographic example the long preservation of ancient forms of speech in remarkable purity in Iceland, an out-of-the-way island; and, by way of contrast, we like to mention Malta, an island that is very much in the way, where the mingling of peoples has resulted in the mixture of Arabic and South-European tongues. We have already called attention to the diffusion of organic forms as a fundamental ontographic fact, and we know that variation is an ontographic consequence when diffusion leads to a physiographic environment that involves separation as a result either of distance or of isolation. As examples of this sort of geographic relation, we may point either to the several species of cassowaries on the islands of Australasia; or to the several races of man on the larger divisions of the lands, where barriers formed by the oceans are supplemented by a desert barrier in the Sahara and by a mountain barrier in the Himalaya; or to the several nationalities in Europe, where gulfs and barriers are so important. But why not continue this line of inquiry, and instance, as another example of variation following on diffusion and separation, the differentiation of the Romance languages from Roumania to Portugal, and thus bring in the interesting story of the division of the Langue d'oc and the Langue d'oui by the central highlands of France? Why not include the even more extraordinary story of the words *pecuniary* and *fee,* which have come to look so unlike on their arrival in our composite language, because of their different paths of travel from their common source? This is of just as good geographical quality as is the contrast between the whites and the blacks in our southern States; they began alike somewhere long ago, and have come to be different through long ages of separation before they are again found together: and separation is an important element of physiographic control.

Not only speech but figures of speech are affected by physiographic environment. There are two examples of far-separated maritime peoples who were so impressed by the manner in which a boat is guided by its rudder that they both came to use a word, which primarily meant a stick and secondarily a stern oar, in a later figurative sense, meaning the guidance or control of a whole people. One of these examples is found with the Scandinavians, where the same word is used in "the helmsman *steers* the boat" and in "the king *steers* the people": here the original and the figurative meanings of the word both survive to-day. The other example began with the people of the eastern Mediterranean, and is now spread through all the Romance languages, and into the Romance element of English. French still preserves the original sense of the word in *gouvernail,* for rudder; but we have lost that sense, unless perhaps in a passage in the Bible concerning the "governor" (helmsman or captain) of a ship, and only know the figurative sense: the word "govern" is therefore a long-lasting response to an early maritime environment. In both these cases it is as legitimate to instance an effect of environment on language as to instance its effect on industry.*

The Practical Value of Defining the Content of a Subject.—In occasional conferences with some of our members on such questions as have been treated in this address, I have gained the impression that they attached relatively little value to abstract considerations, and that it sufficed them to go on with their work without inquiring particularly into the general content of the subject under which it belonged, without attempting to develop what may perhaps be called the more philosophical view of the subject as a whole. There was a time when I shared this indifference to abstract inquiry —a time when I was, as it were, overwhelmed with the great quantity and variety of material with which I had to make myself more or less familiar, and when there seemed to be no more need than there was occasion of bringing it all under an orderly and systematic scheme. But that time is now a good many years ago, and since then I have passed out of the stage of life in which, we are assured, our original work is to be completed, and have entered well upon the later stage in which the contemplation and arrangement of work previously done is, we were told, more attractive than the accomplishment of new work. It is, perhaps, for some such reason

* Since presenting this Address, a missionary has told me, in response to the question: "What is the Arab word for *govern*, and what is its origin?"—"It is a word that means *guide*, and is derived from the word meaning to guide a horse."

that this opportunity for addressing the Association has been devoted to the reading of an essay on the content of geography as a whole, rather than to a report on more concrete matters, such as certain recent observations in South Africa. Nevertheless, I am persuaded that there is a practical value in abstract considerations such as I have presented, even for younger men, and that if a general scheme of work in accordance with some broad and philosophical view of one's chosen science is formulated by a young geographer early in his career, he will profit greatly from it; for he will thus be led more surely and directly to detect all the facts that are pertinent to any inquiry he may enter upon. Such a scheme is always open to modification as experience increases. If the geographer undertakes field study, as I hope he may, either at home, where there is still plenty of field work to do, or abroad, where there is still more to be done, it will serve him well to know as definitely as possible the essential quality of the work before him. If he wishes to become an all-round geographer and to give a thorough geographical account of the region of his field work, he will be greatly aided in keeping his eyes open to the facts before him by bearing in mind the systematic content of the science as a whole, a part of which he proposes to study in the region he has selected.

GEOGRAPHICAL NOTES ON THE WESTERN SIERRA MADRE OF CHIHUAHUA, MEXICO.

By Edmund Otis Hovey (New York City).

Abstract; Illustrated.

The elevated central plateau of Mexico is considered to be a fault block bounded on the east, south, and west by important zones of fracturing and uplift. The controlling faults run N.W.-S.E. and E.-W. The block rises gradually, but not uniformly, from the south toward the north and from the east toward the west. It is not separated structurally from the plateau region of the western United States. Volcanic flows and tuffs form the major portion of the surface material, and most of the remainder has been derived from eruptive rocks. The plateau is, in general, arid or semi-arid, and even the highest parts do not receive a copious rainfall, on account of the line of high mountains and escarpments along the western edge of the elevated block. Bolsons, or pocket-deserts, are numerous over the strictly arid eastern and central parts of the plateau. Many

of these bolsons contain lagunas which receive the waters of the streams from the mountains, but have no outlet.

A journey undertaken for the American Museum of Natural History during the winter and spring of 1905, in company with Prof. R. T. Hill, enabled the author to observe the plateau from Ciudad Juarez southwestward and southward into the heart of the western Sierra Madre for a distance of about 500 miles through a region which is practically unknown to American geologists. The principal lesson which was impressed upon the mind was the geographic cycle in the desert or semi-desert. Stress was laid upon the strains due to the great diurnal variations in temperature as an agent of the highest importance in the breaking up of the rocks. Transportation down the slopes is due to gravitation, sheet-floods, and winds. Wind performs an immense amount of work in a region under a dry climate, not only in transportation but also in sculpture. Its action is very variable. Bolsons are found in original basins between the volcanic centres, or in basins made by the wash and slide-rock coming down from the disintegrating mountains.

The inclosed basins of the high plateau of the Western Sierra Madre are no longer arid; but they have had a history like that of the bolsons, and they are an indication of the previous existence of a more arid climate than now exists in the high mountains. The drainage systems of the high plateau are of great interest. There are streams like the Casas Grandes with sources in the great cordons which flow out into lagunas in the deserts. Other streams discharge into lagunas in the high inclosed basins like the Llano Bavicora. The headwaters of some of the streams are cutting back into and capturing the drainage of inclosed basins, as at Llano Cristo on the Hacienda San Miguel.

The Pacific drainage (into the Gulf of California) is gradually eating its way eastward through the Western Sierra Madre and capturing the internal drainage. The Aros has thus captured the Mulatos, the Tutuaca, the Chico, and the Verde among the large streams, which are trunk streams gathering the waters of hundreds of consequent streams draining the cuestas. The main trunk of the Aros flows in a direction directly contrary to the consequent streams on the cuestas. It is the main tributary of the Yaqui River. In the magnificent grand cañon of the Aros and along its tributary arroyos are exposed many local "basin conglomerates" which indicate the location of extinct inclosed basins, or bolsons. The sharp V-shaped cross section of the great cañon denotes its still youthful stage.

The paper was illustrated with lantern-slides from photographs made by the author for the American Museum of Natural History.

LAKE LOEN (NORWAY) LANDSLIP OF JANUARY, 1905.

BY A. P. BRIGHAM (Hamilton, N. Y.).

Abstract; Illustrated.

Lake Loen is one of three lakes occupying a radial position at the head of Nord Fiord, and is surrounded by steep-sided mountains four to six thousand feet in height. The slip occurred about midnight, January 15, near the head of the lake. A veneer of talus slid from a rock slope 2,000 feet in height, raised the adjacent lake floor from a depth of 30 fathoms to 10, and sent waves across to neighbouring settlements, destroying strongly-built houses and occasioning the loss of 61 lives. A small steamboat was stranded on the opposite side at a height of 40 metres above the lake surface. The waters were raised 6 metres at the foot of the lake, about six miles away. The duration of the catastrophe was about two minutes.

HOGARTH'S "THE NEARER EAST" IN REGIONAL GEOGRAPHY.

BY ISAIAH BOWMAN.

Abstract.

"The Nearer East" illustrates a method in Regional Geography and helps as well toward a better conception of Systematic Geography. "The Nearer East" includes Greece, the Russian Baltic and Caspian Provinces, Armenia, Syria, Persia, Arabia, and Northwestern Africa. The region thus circumscribed is considered a natural province or region on the basis of similar or closely-related climatic, topographic, and ethnographic qualities, coupled with a certain distinction of position between Central Europe on the one hand and the Farther East on the other. The boundaries are in part political and subject to change; in part physical, and in so far relatively unchangeable. The basis of division indicated is more specific than in the system suggested by Wallace. Herbertson's boundaries of the "Natural Geographical Regions" (*Geographical Journal,* Vol. 25, 1905, p. 309) are drawn on the same basis, but the difference in the location of the boundaries is perhaps to be attributed in part to the limitations of publication in the case of Hogarth's work. Structure (geology) is placed after the chapters in which the topography is discussed instead of being made incidental to topography. A distinct feature is the division of the book into two parts, in recognition of the two-fold character of Geography.

The first part deals with the physical conditions exhibited in the region; the second part deals with man, his distribution, grouping, life conditions, etc. The distribution and occasionally the interrelations of plants and animals are discussed, but separate chapters are not devoted to organic responses of this type. We have here, then, a treatment differing from that of the anthropogeographer, in that it includes a large part of all the ontographic responses found in the region, though systematic arrangement of the human responses only is attempted, plant and animal responses being treated as secondary phenomena which are included only in so far as they become factors in more or less immediate control of man's distribution, grouping, etc. Vivid and pleasing landscape descriptions influence very profoundly our interest in geographical study, and the chapter on "Physical Circumstance" is certainly a good illustration of such description.

"GLACIAL EROSION IN THE NEW ZEALAND ALPS."

BY GEORGE C. CURTIS (Boston, Mass.).

Read by Title. Abstract.

In 1902 an account* was published by two eminent European scientists, stating that after examination they were disappointed to find in New Zealand no signs of recent glacial erosion, such as are recognized nearly everywhere in the European Alps and in Norway.

These geologists saw but one side of the lofty northeast-southwest range of the New Zealand Alps; had they made the rough trip to the western side, they doubtless would have reported differently.

In contrast to the sharp peaks and aiguille topography of the Swiss Alps, the New Zealand Alps are remarkable for their great talus-slope development, which is considerably more prominent on their eastern side; the predominance seems due largely to the presence of morainal dams which block and retard the disposition of the waste from the mountains above; the processes of erosion are thus checked to such a degree that the vast amount of waste characteristic of lands in this stage of development collects in the upper valleys and piles up from the bases of the peaks until their lower crest-lines are nearly smothered. Thus the surface bed-rock is much covered and protected, and the transportation of its waste is comparatively slow, accounting for its loose and broken condition high above, as

* 1st An. Rep. N. Z. Govt. Health and Tour. Dept.

well as at the surface of the large valley glaciers. The prevailing absence of signs of recent glaciation on the eastern side may be accounted for by these conditions, which do not permit of sufficient resistance in the rotten bed-rock to offer a chance for abrasion by the moving ice.

On passing over the range to the western side (where the morainal dams have been cut away) a difference of conditions immediately manifests itself; talus is less conspicuous, and glaciated surfaces are quite apparent. Along the lower portions of the somewhat smaller glaciers of this side, not only do we find evidence of past strong glacial erosion in the terraces gouged deeply in the smoothed and grooved bed-rock of the valley sides, but glacial cutting and striations on the rock at the very edge of the ice, where the action of grooving and gouging may literally be observed in process. On the surface of the medial and lateral moraines, especially in the vicinity of the enormous terminals, I found not only freshly-striated but freshly-polished blocks—additional evidence of glacial erosion.

PHYSIOGRAPHIC NOTES ON SOUTH AFRICA.

By W. M. Davis.

Abstract.

The speaker had opportunity last summer, as guest of the British Association for the Advancement of Science, to visit South Africa and to gain a general view of that region during a land journey of thirty-three days. In the southwest, the north-and-south ranges of heavy Table-mountain sandstones rise, ragged and treeless, between lowlands of erosion available for agriculture; several of these ranges are of synclinal structure. The Table-mountain range itself is one of this system, with Capetown at the northern end and Cape of Good Hope at the southern end; it is tied to the mainland by a low sandy belt, apparently wave-built. Farther inland the east-and-west anticlinal ranges of various sandstones rose, with simpler forms and extended surfaces of bare rock, over lowlands and hilly belts with a scanty vegetation adapted to the arid climate; a large part of this district is too barren for successful occupation, except in small and far-scattered farms where water supply is available. The rivers here have cut deep gaps in the ranges. The plateau country, farther in the interior, is of horizontal strata in its southern part and of disordered strata or of granite in its northern part; its altitude is from

4,000 to 6,000 feet. It is for the most part a widely-extending peneplain, interrupted by more or less numerous monadnocks in the form of knobs, ridges, and tables of volcanic and other resistant rocks. Most of the streams of the plateau do not incise new valleys beneath its gently-undulating surface until they approach the border of the high ground; there they descend by strong slopes with many rapids and falls. The short streams of Natal are encroaching by headwater erosion on the longer streams of the Orange river system, where the two rise against each other in the eastern part of the plateau country. The region is treeless over the greater part of the area visited, but a thin forest of irregular and awkward trees was passed through in western Rhodesia on the way to the Victoria falls of the Zambesi river, whose zigzag gorge, worn in horizontal sheets of basalt, is a striking example of young river erosion.

The plateau country is for the most part available for cattle-raising where water can be had; but the number of cattle seen was small, owing to the losses during the Boer war and to the ravages of cattle diseases afterwards. The rarity of lofty mountains rising above the plateau leaves the streams dependent almost entirely on the irregular summer rains, and therefore subject to great fluctuations in volume. Irrigation is needed, but is not easily accomplished.

FLOODPLAINS PRODUCED WITHOUT FLOODS.

By N. M. Fenneman (Madison, Wis.)

The word "floodplain" is probably associated in most minds with floods. When not thought of as denoting a surface built up by the sediments from flood waters, it is generally understood to imply liability to occasional overflow. Several of the modern text-books of Physical Geography (Davis, p. 286; and Tarr, p. 288) speak distinctly of another process which contributes to the building of floodplains—namely, that of lateral accretion on the inner side of a meander curve. It may be profitable to point out more explicitly that (1) there are two distinct processes, either of which is capable of producing floodplains; (2) these correspond to the two recognized modes of transporting undissolved material—that is, by suspension and by rolling on the bottom of the stream; (3) either one of these processes may produce a floodplain without the co-operation of the other, and (4) examples of floodplains so produced may be pointed out.

Wherever a stream meanders, it digs away its outer bank while the inner is building up to the water-level by the deposition of material brought there by rolling or pushing along the bottom. This is *lateral accretion*. Its characteristics are—(1) coarseness of the material, which is frequently sand and may be cobbles or boulders; (2) a rude cross-stratification dipping streamward at the angle of the bank's slope; (3) a smaller streamward slope of the finished plain if the stream be a cutting one.

If the stream be subject to overflow, sediment must settle from suspension in beds conforming to the surface. This is *vertical accretion*. Its characteristics are (1) the fineness of the material, mud; (2) the approximate horizontality of the laminæ. The resulting surface may slope either toward or from the stream according as the stream is degrading or aggrading its channel. If the two modes of accretion co-operate, the contribution made by each may be detected by the nature of the material and its bedding. Commonly a section of a floodplain or terrace will show the coarse accumulations of lateral accretion below, covered by the fine alluvium due to vertical accretion.

The building of floodplains by vertical accretion alone, while entirely possible, must involve peculiar conditions—for example, human agency—to prevent meandering. The opposite case is exemplified in the following illustration.

White River, the outlet of Lake Geneva in southern Wisconsin, presents in diagrammatic perfection a floodplain built by lateral accretion alone. The lake has an area of 8½ square miles, and it therefore acts as a regulator of the river's flow, the extreme recorded variation in the water-level being 27 inches. In seventy years the stream is known to have overflowed but once, and then only by the breaking of the dam at the outlet. As the floodplain suffered no important change on this occasion, the event may be disregarded.

For at least a fourth of a mile below the outlet, White River flows between steep bluffs of coarse glacial gravel, bordering a floodplain about 400 feet wide. Through this plain the stream flows in tortuous meanders, the channel being somewhat more than two feet deep. Those banks which are being excavated by meanders show the re-deposited kame gravels not covered by any finer material except the remains of decaying vegetation. The facts made plain by these observations are as follows: (1) This floodplain is due entirely to planation and lateral accretion, floods not co-operating. (2) The plain is not aggrading, and cannot in the nature of the case do so. (3) These facts might be determined from the

structure of the plain itself without human testimony concerning overflow. (4) Similar instances are probably abundant on streams whose flow is regulated by lakes or swamps.

THE BORDER BELTS OF THE TARIM BASIN.

By Ellsworth Huntington (Milton, Mass.).

[The following description is taken from letters written by Mr. Huntington to Professor Davis during a journey as a member of Mr. R. L. Barrett's expedition to Central Asia.]

Khotan, Chinese Turkestan, 12 July, 1905.

The Tarim basin is bordered on the south by a series of concentric zones. Where we entered the basin, southwest of Khotan, the zones are as follows:

1. The Plateau Zone lies at a height of from 15,000 to 18,000 feet. Its gentle slopes afford abundant soil, and there is a fair supply of water. The temperature is so low, however, that no vegetation can grow except large orange-green lichens and an occasional bit of grass in some low, sheltered spot. The only animals are wild sheep, which seem able to live on the lichens and grass, and ravens and wolves, which eat the carcasses of the dead animals of burden. On the main road the ravens were numerous, but as soon as we left it they disappeared.

2. The Granite Mountain Zone rises on the northern edge of the plateau to a height of 24,000 feet, and descends on the north to 15,000 feet. There is plenty of moisture, mostly in the form of snow and glaciers, but the slopes are too steep to hold much soil and the temperature is too low to support plants. Therefore it is practically lifeless.

3. The Mountain Pasture Zone includes the heads of north-sloping valleys from an elevation of 11,000 to 15,000 feet. Between the valleys rise mountains partaking of the character of one or the other of the adjacent zones. Old moraines deeply covered with loess at the heads of the valleys, and steep slopes of loess lying against the valley sides farther down the valleys furnish abundant fine soil. The proximity of the high mountains causes frequent light rains during summer. For from three to five months the temperature is fairly warm. Accordingly, abundant grass flourishes. Marmots are almost the only wild animals. Man has taken advantage of the rich grass for his flocks and herds. As the pastures are only available for three months, he must be nomadic. The

limited space afforded by a steep-sided mountain valley makes it impossible to move freely from place to place. Moreover, the winter pastures at lower levels are also restricted. Hence nomadism has not that full development which exists to the west and north, where the relatively low plateau zone is covered with grass and allows free movement. Year after year the same people of this region come to the same place. They live in poor, low tents or in caves in the loess. The women are generally left behind.

4. The Paleozoic Mountain Zone extends from near the stream sources down to an elevation of about 7,500 feet; here the streams run in narrow gorges cut in metamorphic Paleozoic strata. The sides of the valleys and the sheltered parts of the intervening ridges are often covered with dissected deposits of loess. At a little distance from the high zone of granite mountains the precipitation decreases greatly. Thus, though the temperature is propitious and there is fine soil in some places, the zone is desert. The flora is of the sage-brush type. The fauna consists of animals such as rabbits and lizards.

5. The Tertiary Zone of Loess Terraces occurs within the Paleozoic zone along a belt of soft Tertiary strata. Here at an elevation of from 6,000 t[illegible],000 feet the valleys broaden and are bordered by low terrace-plains of loess. The interfluves consist of low, rounded hills covered with fine sand and loess; they are too dry to support anything but a meagre desert flora. The terraces are easily irrigated; their long, narrow strips support prosperous villages, the most attractive part of Chinese Turkestan. Most of the staple grains, except rice, grow excellently, as do all the hardier temperate fruits—apples, pears, peaches, apricots, etc., but not grapes or figs. The summer days are hot, but the nights are cool. The winters are cold and bracing, though snow does not remain long.

6. The Piedmont Gravel Zone embraces long slopes, which descend a thousand feet from the lower edge of the Tertiary Zone. The soil is poor and there is no water. The zone is absolutely desert, almost devoid of life.

7. The Oasis Zone follows the gravel slope as it gradually gives place to a plain of fine alluvial material which seems to be identical in composition with the loess of the mountains. Here the mountain streams divide into distributaries which are easily led to all parts of the smooth plain. All the conditions are highly favourable to life. Most of the population of the Tarim basin and all the large cities are located in the oasis zone. The crops consist of those of the Tertiary zone, with the addition of rice, cotton, grapes, etc.

8. The Swamp or Winter Pasture Zone lies farther forward in the basin. During the summer flood season a large amount of water runs past the oases, forming extensive swamps. Here poplars, reeds, tamarisks, rushes, and coarse grass furnish the people of the oases with fuel and with abundant winter pasture for their flocks. Because of the varying size of the rivers the swamp zone departs widely from the concentric or belted form which is so characteristic of the other zones.

9. The Sandy Desert Zone lies beyond the swamps; it is the Takla Makan, the great lifeless sand desert which forms the kernel of the Tarim basin. On its edges fingers of sand extend outward between the swamps. In many places the swamps and the sand are intimately commingled. The latter is gaining ground at the expense of the former, as appears from the belt of dead and dying poplars which stretches for many miles into the sand. Apparently here, as in many other cases, we have the record of a recent change of climate.

All of the nine zones of the Tarim basin show typical desert features. Three of the zones—namely the Granite Mountain, the Piedmont Gravel, and the Sandy Desert—consist of unmitigated desert, in which human life cannot possibly find support. Another zone, the Plateau, varies from unmitigated desert, where it is most elevated, to prolific pasture lands, where it falls to a height of ten or twelve thousand feet. A fifth zone, the Paleozoic Mountain, is almost entirely desert, although in an occasional broadening of a valley bottom one or two families find sustenance. The four remaining zones—namely the Mountain Pasture, Tertiary, Oasis and Swamp Zones—all support vegetation, and hence are adapted to human life. Yet in even the best of them, the Oasis Zone, the habitable area is probably less than a tenth of the total.

It is noticeable that each of the four habitable zones is characterized by deposits of fine yellowish material or loess, partly of æolian and partly of aqueous origin. This loess is still in process of deposition, which takes place as follows: Four days out of five the air over both mountains and plain is filled with a thick yellow dust haze. In the mornings the air is quiet or is lightly stirred by a south wind. Whirlwinds occur by the thousand—one can often count twenty or twenty-five at a time—and great quantities of dust are wafted upward. At noon the wind shifts toward the north and increases in strength. By the end of the afternoon it has reached the northeast and is blowing hard. The dust in the upper air is carried many miles toward the mountains, while coarser particles—

that is, the finest grains of sand—are picked up and carried to the foothills. On reaching the high mountains and also everywhere at night the force of the wind decreases, and the dust and sand fall to the ground. In the high mountains the deposition of dust is aided by the frequent showers which fall in the afternoon or evening. The showers are too light to cause much run-off and erosion. They suffice, however, to cause a thick growth of grass, and the grass retains practically all the dust which falls upon it. Thus thick deposits of æolian loess are still in process of formation in the Mountain Pasture Zone. Lower down much of the dust is washed away, because of the absence of vegetation. It goes down the streams to form the terraces and the alluvial plain. Much of it is doubtless picked up again by the wind and returned to the mountains, so that there is a genuine circulation of loess-making material. Dissected deposits of loess in the Paleozoic (and Tertiary) Zones show that probably during glacial epochs the pasture zone of grass was wider than now, although the sandy desert was then as lifeless as to-day, except where the Swamp Zone encroached farther upon it.

Apparently the requisite conditions for the deposition of loess are—(1) a gathering-ground free from vegetation and exposed to strong winds; (2) a prevailing strong wind in one (or two) directions; and (3) a depositing-ground where the wind is checked and where there is sufficient vegetation to hold the falling dust. The gathering-ground, I suppose, may be either a desert, a floodplain, a seashore, a playa, a moraine, or any place where the wind can pick up sufficient fine dust. The depositing-ground may be high mountains or low hills, but it is not likely to be a plain.

TAM EGHIL, CHINESE TURKESTAN, 13 Sept., 1905.

The occurrence of geographical zones around the Tarim basin, mentioned in my last letter, appears to obtain in a general way for a thousand miles east and west and for nearly five hundred miles north and south. The zones are developed most fully and typically along the south-western border in the two hundred miles from Khotan to Yarkand. To the west and north in the Tian Shan region, as I saw it in 1903 when travelling there for the Pumpelly-Carnegie Expedition, the mountains decrease in height and the upper pasture zone expands at the expense of the more rugged zone of naked peaks and snow fields. The Terrace Zone, on the other hand, dwindles there, because the winds, being prevailingly from northern quarters, carry little or no loess to that side of the basin;

hence, there the terraces consist largely of coarse gravel. Moreover, the warping by which the Tian Shan plateau was uplifted has produced a stronger slope than that which leads up to the Pamirs and western Kuen Lun. Hence the northern streams, being shorter and more torrential than those on the south, have less opportunity to form terraces.

East of the two hundred miles where the zones are best developed they diminish in another fashion. The long monocline by which the mountains on the west are reached gives place to a fault. The zone of Paleozoic mountains disappears. A range of rough granite peaks rises abruptly from the Tertiary Zone of gently-sloping, loess-covered hills. At the foot of the pronounced escarpment thus formed the Tertiary hills reach a height of 10,000 feet or more. They are so high and so close to the lofty main range that their upper portions receive abundant summer rains and form the beautiful mountain pasture zone. Lower down, and at a short distance from the mountains, the green pasture slopes merge into rolling hills of sand and loess, between which plains of loess support prosperous terrace villages. Still farther north the gravel zone, like a huge shingle beach from five to twenty miles wide, borders the sea of sand on whose edge lie the oases. Most of the rivers from the mountains disappear in the gravel zone, though they come to light again in the form of springs in the silt or fine sand of the oasis zone.

The main roads follow the habitable zones. The chief road is like a thread along which are strung the oasis beads. A second road connects the villages lying on the loess terraces, and a third lies in the pasture zone at the foot of the escarpment. The latter is known as the "old" or "Kalmuck" road, because it was much more important in former times when Kalmuck nomads wandered over the foothills with their flocks. There are traces of a fourth road lying forty or fifty miles north of the oases, in a zone where there is now nothing but sand, though in the past there seems to have been a series of small oases along it. I am getting some camels preparatory to an attempt to visit one of these old oases, so as to see whether there is any evidence that the mountain rivers once flowed to it.

KERNJA, CHINESE TURKESTAN, 9 Oct., 1905.

During the last three weeks I have been having a most interesting trip with camels into the sand country. Once the guide failed to find the well, and the camels had to go four days without water.

The chief result of the trip is that on a single line, which would be the prolongation of a group of streams from the mountains if they had water enough, there are five abandoned villages, growing successively older as one goes out upon the desert. They were abandoned at approximately the following dates: A. D. 300, 800, 1300 (probably two at this time), and 1841. Nearer the mountains and at the end of one of the streams lies the youngest village, settled in 1841, when the most recent of the other villages was abandoned. The cause of the recent abandonment was the decrease of water supply in the stream. There is a well-known tradition to the effect that the abandonment of the village in 1300 was due to the same cause. It seems probable that the earlier abandonments were due also to failure of water supply. I am going to give further study to this question.

There is strong confirmation to be found in the desert hereabouts of the idea that the cross-bedding of the Colob (Jurassic) sandstone which I saw in southern Utah in 1902 is of æolian origin. I have a photograph of a section of a sand deposit here which might almost pass for a part of the Colob sandstone in the White cliffs in Utah.

PHYSICAL FEATURES OF THE JORDAN VALLEY.

By William Libbey

(Professor Physical Geography, Princeton University).

Abstract; Illustrated.

The physical characteristics of Palestine make it one of the most interesting regions on the globe.

Rising from well-developed coastal plains to a plateau region near the Mediterranean, it reaches its greatest altitude in the north in the Lebanon and Anti-Lebanon chains. These ranges terminate in the south in Mount Hermon; between them is a depressed valley, which is remarkable in many ways but not so famous as its companion rift valley south of Mount Hermon, known as the Jordan Valley.

South of Mount Hermon there seem to be evidences of a transverse break running east and west, along which volcanic masses of lava have been extruded.

The Jordan Valley, or the river itself starting at Banias, its most

abundant source, has an elevation of about 600 feet above the sea-level. Passing downward through the marshy Huleh, it reaches a point some 600 feet below sea-level at the Sea of Galilee. The marshes of the Huleh are produced by the rocky barrier above Jisr Benat Yakub; below this place the river becomes a torrent, in strong contrast to the upper part of the stream.

From the Sea of Galilee southward the river passes over a comparatively level valley, into which it has cut a deep meandering trench which is three times as long as the air-line distance, and during this part of its course it has a fall of as many feet to the mile as the average river has inches of descent, the Dead Sea being 1,292 feet below the level of the Mediterranean.

The plateau east of the Jordan has an elevation of 1,200 feet above the sea-level at Banias, and this elevation increases continuously as you travel southward. We passed over the plateau as far as Petra, and at that point found it to have an elevation of 5,700 feet above sea-level, the rocks throughout being Cretaceous limestone.

Petra, the ancient stronghold of Edom, is located in a pocket in the sandstone mass which has been deposited in a large "bay" on the eastern side of this limestone valley edge—3,000 feet below the level of the plateau.

The structure of the sandstone, being wavy throughout, and the character of its component grains indicate that the mass was deposited in shallow, brackish water. The sandstone west of the Jordan, particularly such remnants as are found west and south of the Jebel Usdum, at Zaweirah, and Jericho, and northward nearly to the Sea of Galilee, indicate the extent of the deposit.

Lines drawn along the top of the plateau and the top of this sandstone horizon are parallel.

Would not all the above details lead to the following conclusions: that after the rift valley had been formed it was widened and deepened, then slowly depressed while this mass of sandstone was being deposited, and afterwards the region was elevated during the formation of the present valley?

The flow of the river to the Gulf of Akabah was stopped when the sandstone had been cut through to the harder rock, about ten miles south of Petra in the Arabah Valley; and the elevation continued until this obstruction was nearly 1,000 feet above sea-level.

From this time the obstruction became the watershed, throwing the waters both north and south. All of the points except this latter one, the character of which is well known, were visited, and the elevations tested by many barometrical readings.

OBSERVATIONS ALONG THE FRONT OF THE ROCKY MOUNTAINS IN MONTANA.

By Lawrence Martin.

Abstract.

[The following study was made in September, 1905, along the front, or Lewis, Range between the Great Northern Railway and the International Boundary in connection with a course at Harvard University under Professor W. M. Davis. See Chief Mountain and Browning topographic sheets.]

The front range in northern Montana shows striking differences from the margin of the Rocky Mountains farther south—for instance, in the Front Range of Colorado, where an unroofed anticlinal uplift with granite core and overlapping sediments produces (1) offlying hogbacks, (2) very even front, and (3) streams in narrow cañons. The Lewis Range contrasts with synclinal structure (observable from the railway pass, which is unique in having its divide at the very front of the range on the edge of the plains), and overthrust structure, producing (1) no hogbacks, (2) an embayed front, and (3) streams in wide valleys. The overthrust, worked out by Willis, superimposes indurated Algonkian on weaker Cretaceous, here visible for over seven miles. This hard on soft produces cliffs above and gentle slopes below, the mountains rising 4,000 feet directly from the plains.

The widely-open valleys are embayments four to nine miles broad, and reaching a third of the way through the range, being terminated where the hard Algonkian, descending westward with the syncline, meets the ascending profile of the streams. This fall line is always marked by a cascade, except in the valley of Upper St. Mary Lake, where it is drowned. The embayments are (1) simple (Kennedy Creek valley with one stream), or (2) drained by several streams (notably the Swiftcurrent, Upper St. Mary Lake, and Belly River embayments). They may be due to glaciation, as suggested by Professor Chaney, or modified by the coalescing of single valleys. Between these embayments long spurs extend, and one, Chief Mountain, is cut off behind and rises as a 9,000-foot tower in front of the range, like a stack on the seashore.

Normal stream and subaerial erosion has produced square towers and roof-like ridges in the nearly horizontal strata. Intense glaciation has cut deep troughs, headed by cirques with tarns and small glaciers and with tributaries in hanging valleys.

On the north side of Swiftcurrent and the south side of Upper St. Mary Lake valleys in the discordant tributaries hang at successively lower levels to the westward (*up* the grade of the former

trunk glacier), their hang being determined by a hard stratum in the westward-dipping Algonkian and not by the eastward-sloping glacier.

Swiftcurrent, Kennedy Creek, and others do not seem tó hang above the valley of their former trunk glacier, that now occupied by the north-flowing St. Mary River, a tributary of the Saskatchewan. They appear to enter at grade, over enormous alluvial fans; but borings in the fan of Swiftcurrent Creek reveal a U-shaped rock valley 200 feet below the present grade, showing that Swiftcurrent (and presumably the others) is in a hanging valley, masked by the fan. These are ***buried hanging valleys.***

The Swiftcurrent alluvial fan dams St. Mary Lake, eighteen miles long, and it is also bisected eight miles southward by other alluvial fans, like Lakes Thun and Brienz at Interlaken and the pairs of English lakes, Buttermere and Crummock Water, Bassenthwaite and Derwentwater.

The U. S. Reclamation Service proposes a dam which will raise the level of this lake, drowning the Montana Interlaken. The water will be turned by a twenty-mile canal into Milk River, which flows into Canada, as St. Mary River does, but differs from it in returning again in eastern Montana, so that this water can be used for irrigation nearly 250 miles away from the mountains.

HARVARD UNIVERSITY.

OBSERVATIONS ON GLACIERS AND GLACIATION AT YAKUTAT BAY, ALASKA.

BY RALPH S. TARR (Ithaca, N. Y.) and LAWRENCE MARTIN (Cambridge, Mass.).

Abstract; Illustrated.

[The observations upon which this paper was based were made in the summer of 1905 in connection with a general geological survey of the Yakutat Bay region by a United States Geological Survey party under the direction of the senior author. A grant of money from the American Geographical Society made it possible to add the junior author to the party as special assistant in physiographic and glacial geology. Published by permission of the Director of the United States Geological Survey.]

Yakutat Bay forms the only important break in the straight stretch of coast-line between Cross Sound, just north of Sitka, and Kayak Island. It lies just south of Mt. St. Elias. Starting as a broad, V-shaped bay, known as Yakutat Bay, it changes to a narrow, mountain-walled fiord, called Disenchantment Bay, then turns abruptly in the form of a bent arm, reaching nearly back to the ocean. The portion above the elbow is called Russell Fiord.

The shores of outer Yakutat Bay and of the head of Russell Fiord consist of a low foreland of glacial débris, and on the northwest side of the Bay the great Malaspina Glacier covers the land back of a fringe of glacial deposit. Disenchantment Bay and Russell Fiord occupy great valleys in the foothill section of the St. Elias chain, with mountains rising from 4,000 to 5,000 feet. Back of this, however, rise many lofty peaks reaching from 10,000 to 16,000 feet in elevation.

In the foothill section there are numerous small valley glaciers, and from the more lofty mountains of the St. Elias chain great glaciers descend through the larger valleys. Some of these, notably the glaciers which unite to form the Malaspina Glacier, descend to the fringing foreland. Others descend to the sea. The Turner, Hubbard, and Nunatak Glaciers are all tide-water glaciers, and the Hidden Glacier descends to a delta deposit built by its outwash in a branch of Russell Fiord.

That the entire bay and fiord were formerly occupied by glaciers is proved by three lines of evidence, as follows: (1) The fringing coastal plain or foreland being of morainic character proves the presence of ice beyond the mountain front; (2) moraines high up on the mountain sides, but lower near the sea, demonstrate the former existence of ice at these elevations; (3) the valley walls, both in the main fiords and in the minor valleys, show clear evidence of powerful glacial erosion. This evidence is in the form of well-defined hanging valleys, straight, smooth walls, grooved and terraced rock sides, and irregularly-fractured rock resulting from plucking.

Between the period of maximum advance and the present time there has been a recession and an important re-advance of the ice. This is proved by the presence of extensive gravel deposits along the sides of the fiord, in which are found tree trunks, in some cases in place, proving that at the time of the deposit of these gravels trees grew where now none are growing. The surface of the gravels is sculptured by glacial erosion, and on it is laid down a veneer of morainic deposit, proving ice advance after deposit. That this re-advance of the ice did not last long is proved by the fact that it failed to remove completely the interglacial gravels. That the present stage of recession has not reached as far back as the earlier recession is proved by the fact that several glaciers, notably the Hidden, have their ends resting on these older gravels. It is probable that this re-advance is the one which is reported by Malaspina and Vancouver in 1792 and 1794 respectively, when they

found Disenchantment Bay blocked by glaciers. In any event, the recession is of such recent date that vegetation has not yet encroached upon the gravels near the glaciers.

That there was, between 1892 and 1899, a general recession of the glaciers of this region was shown by Gilbert, and our observations prove that this recession has been in progress since 1899 in all of the glaciers studied except two. It was found possible to reoccupy the sites from which photographs were taken by both Russell and Gilbert, and by means of photographs to show the amount of recession. Plane-table maps were also constructed. Of the large glaciers the Nunatak and Hidden show marked recession; but the Turner shows an advance since 1899, and the Hubbard a very distinct advance since that date.

The deposits along the margins of the glaciers present some interesting features. Of these, one of the most important is the evidence of exceedingly slow melting of the débris-covered ice, and the character of the moraines accumulated under these conditions. Most of the glaciers have their lower ends covered for a distance of from one to several miles with rock débris, and oftentimes the exact edge of the ice could not be determined. The Hidden Glacier offered a marked contrast to the others whose ends were on the land in having a complete absence of marginal morainic veneer. Here, however, the wasting end of the ice is covered by a deposit of outwash gravels, forming a perfect outwash plain, which, by the melting out of the ice from beneath, is developing a pitted topography for a distance of over a mile from the visible end of the ice tongue. These deposits along the margin of the glaciers throw some light upon the origin of deposits terminal to ice tongues.

A more complete account of the observations on the glaciers of the Yakutat region will be published in later numbers of the BULLETIN.

THE IMPORTANCE OF SUSTAINING A SPECIAL JOURNAL OF GEOPHYSICS IN THE ENGLISH LANGUAGE AS REPRESENTING THE HIGHEST DEVELOPMENT OF PHYSICAL GEOGRAPHY.

BY CLEVELAND ABBE (Washington, D. C.).

Abstract.

Geographers have usually devoted themselves to explorations and studies that relate to the surface of the earth. Humboldt and Ritter expanded our ideas of physical geography so as to include the

comparative inter-relations of all the features of the superficial globe and their bearing on animals and plants and on the development of the human race, including, of course, climatology.

During the present generation geography has been further extended to include the elastic and thermal phenomena of the globe, or dynamic geology, the ocean and its motions, the atmosphere and its motions, magnetic and seismic phenomena, and sometimes vulcanology. Now, these six subdivisions of the study of the earth are simply applications of our knowledge of the actions of forces—that is to say, of energy. They deal with the essential physics of the globe. In Germany the former half of physical geography is *Erdkunde;* this latter is *Geophysik.* The ordinary journals of geography are descriptive and cartographic. The newest tendency is strongly towards the experimental and mathematical treatment of problems that are fundamental to our knowledge of the origin of the earth and the development of its geographic and physical features. The study of this latter subject will be greatly furthered by the establishment of a journal in the English language as devoted to its interests as is the German publication, Gerland's *Beiträge zur Geophysik.* At the present time the literature of the subject is so scattered as to render it difficult to know where to publish a new memoir or where to find an old one.

Dr. L. A. Bauer has found it proper to extend his admirable journal "Terrestrial Magnetism" so as to cover atmospheric electricity and seismology. If now the other closely-allied subjects enumerated above could be included in the scope of this journal then the needs of geophysicists would be satisfied.

THE INFLUENCE OF GEOGRAPHY ON THE EXPLORATION AND SETTLEMENT OF ALASKA.

By Alfred H. Brooks (Washington, D. C.).

Abstract.

This paper presented chiefly the geographic influence on exploration, for the influence on settlement was considered only incidentally. The position of a large percentage of the settlements in the Territory has been determined by the distribution of gold, often in apparent defiance of geography. This, then, is a geologic and not a geographic control of man's habitations.

Man's advance in Alaska has been determined by four geo-

graphic features, namely: (1) Position relative to other land masses, (2) extent of coast-line, (3) intensity of relief, and (4) water-courses. A study of a chart of the world shows the juxtaposition of Alaska and Siberia, their extremities being separated by a strait only 54 miles in width. Of greater importance is the chain of Aleutian Islands which almost bind the two continents together. These offered guide-posts to the inexperienced navigators in their quest for furs who first explored the Alaskan coast, using Siberia as a starting-point.

Alaska being isolated from the rest of the continent, forming as it does a great peninsula thrust out between the Pacific and Arctic drainage, had much to do with its remaining unknown so long after much of the rest of the continent had been explored. Its position, however, made it the natural goal for those navigators who explored the eastern shore of the Pacific.

The extensive coast-line (exceeding 20,000 miles) has made much of this land accessible to the explorer and settler. Along the Pacific seaboard open to navigation throughout the year the many fiords, harbours, and sheltered waterways have done much to make this the first part of the territory to be settled and explored. The Bering Sea and Arctic Ocean littoral, though open to navigation for only part of the year, was also, because of its accessibility from tide-water, among the first provinces to be explored.

The four broad topographic subdivisions of western North American—namely, the Great Plains, the Rocky Mountain System, the Central Plateau region, and the Pacific Mountain System are recognizable throughout Alaska. These geographic features, together with the drainage systems and climatic conditions, have dominated the exploration and settlement of the great inland province embracing over half the area of the Territory. The settlements along the Pacific during and long after the Russian occupation were kept from spreading inland by the snow-clad ranges which skirt the seaboard. The Pacific Mountain System varies from a width of 50 miles in Southeastern Alaska to over 200 miles at the apex of the Gulf of Alaska, then to the southwest narrows down again to less than 20 miles in the Alaska Peninsula. The shortest route from tide-water to the Yukon Basin is through the Coast Range in the Panhandle. This route, long used by the natives, was adopted by the white men over a quarter of a century ago, and was well established when, in 1897, the Klondike excitement carried thousands of gold-seekers across the Chilkoot Pass.

Though several rivers, such as the Copper and the Alsek, traverse

the coastal mountains, they are unnavigable, and hence played no important part in determining the routes of approach. The Valley of the Sushitna does, in fact, present a feasible route into the interior; but as this lies in the broadest part of the Pacific Mountain System, it has not yet been extensively used.

The Rocky Mountain System forming the eastern barrier long marked the western limit of exploration from the Atlantic. It was not until Mackenzie had traversed this barrier in 1793 that exploration began from this direction. The Central Plateau region, bounded on either hand by great mountain systems, would be relatively inaccessible were it not for the two great rivers, the Yukon and Kuskokwim, which carry most of its drainage to Bering Sea. The Yukon, the main artery of an extensive drainage system, gives access to much of the vast intermontane region. Its thousands of miles of navigable waterways have long formed the great highways of inland travel, in summer by boat and in winter by dog team. The Kuskokwim River, second in size only to the Yukon, has also afforded routes of travel to the explorer, fur trader, and prospector.

To recapitulate: Alaska's peninsular form and irregular shoreline, with the concomitant extent of coast-line, have given ready access to much of the Territory. Its proximity to Asia determined that the first explorations should be from the west. The almost unbroken series of coastal mountains along the Pacific for a century shut off man from the inland region, and the Rocky Mountain barrier on the east retarded exploration from that direction. On the other hand, the extensive inland waterways of the Yukon and Kuskokwim Rivers afford routes of approach from Bering Sea.

It is impossible within the compass of this paper to summarize the early explorations which, all following routes determined by the above-described geographic features, came from three directions. The Russians, approaching from the west across Siberia and Bering Sea, were the first in the field. Then came the navigators of various nationalities, who reached this region from the south by following the eastern shore of the Pacific. At a much later date the English fur traders, after having traversed the entire continent, came into the Yukon Basin from the east.

Bering, the discoverer of Alaska, made his first voyage in 1728, but did not make a landing on the coast until his third voyage, when he reached Kayak Island, and sighted and named Mt. St. Elias. Chirikof, about the same time, attempted a landing near Cross Sound, but was repulsed by the natives.

The return of the survivors of Bering's crew brought the news of a new fur-bearing region, and the succeeding half century witnessed the gradual encroachment of the Siberian traders from the west along the Aleutian Islands. In 1778, Capt. James Cook began that brilliant series of explorations by English naval officers which continued for over half a century, and to which we owe much of our knowledge of Alaska's shore-line. Spanish voyagers also made some coastal explorations. The most important work of the Russians was the exploration of the lower courses of the Yukon and Kuskokwim Rivers. The English fur traders reached and explored the upper Yukon in 1848. In 1866 this work was extended by the explorers of the Western Union Telegraph Co. The later explorations are not here dwelt upon because geographic features have had less control in determining the routes of travel.

SOME RESULTS FROM THE DRIFT CASK EXPERIMENT IN THE ARCTIC OCEAN.

By Henry G. Bryant (**President of the Geographical Society of Philadelphia.**).

With the view of securing data in relation to the speed and direction of Arctic currents or "drifts," believed to run from the vicinity of Bering Strait north and northwestward across the polar area, some fifty spindle-shaped oaken casks, of twenty-gallon capacity, were constructed in 1898 from designs submitted by Admiral Melville and placed on board a number of steam whalers sailing north from San Francisco, The U. S. Revenue Cutter *Bear* also distributed fifteen of the casks in 1901, while on her annual cruise to Point Barrow. Each cask was numbered and provided with a message printed in four languages, which was inserted in a sealed bottle, which, in turn, was enclosed in a wooden case, before being placed in the cask. The instructions which accompanied each consignment of casks directed the masters of the vessels engaged in the work, before placing the casks adrift, to fill in, in the spaces provided on the message paper, the name of vessel and master, number of cask, the date and the latitude and longitude where cask was placed on the floe ice. The assisting captains subsequently reported to the Society the various positions where casks had been launched, and these data were duly tabulated. Reports of the launching of some thirty-five of the casks were received in this way.

The message paper, consisting of a waterproof linoleum substance, requested the finder to fill in, in the space provided, his name,

date, and latitude and longitude of locality where cask was recovered. The finder was further requested to forward the recovered message to the Geographical Society of Philadelphia.

It was estimated that from three to five years would elapse before any of these messages would be heard from. The promoters of the experiment were gratified when two of the messages were received in Philadelphia in the latter part of October, 1905. An examination of the first record shows that it was cast adrift by Capt. F. Tuttle, of the U. S. Rev. C. *Bear,* on August 21, 1901, about 85 miles N.W. of Wrangel Island, and recovered by Capt. A. G. Christianson on August 17, 1902, near the mouth of Kolyuching Bay, on the Siberian coast. It is evident that this particular cask did not get a good start, and in the one year less four days of its drift the course it followed of 380 miles to the southeast was probably influenced by local currents which exist near Bering Strait.

The other representative of this silent fleet which has been traversing the desolate wastes of the Arctic Seas had a longer voyage, and, doubtless, a more eventful history. Placed on the floe ice northwest of Point Barrow, Alaska, in Lat. 71° 53′ N. and Long. 164° 50′ W., by Capt. B. T. Tilton, of the steam whaler *Alexander* on September 13, 1899, it was recovered one mile east of Cape Rauda Nupr, on the northern coast of Iceland, on June 7, 1905. There can be little doubt that this cask was transported by that slow but persistent current which, starting in the Arctic Sea north of Bering Strait, and aided, perhaps, by the rotary motion of the earth, moves in a northwesterly direction along the Siberian coast, passing to the north of the New Siberian Islands, and, aided by the warm discharges from the Siberian rivers, gains in volume and speed and sweeps around and across the Polar Sea north of Franz Josef Land, emptying into the sea between Greenland and Spitzbergen, and thus eventually reaching the North Atlantic. The drift-cask experiment was undertaken to secure data to prove the existence of just such a current, and the safe arrival of one of the flotilla by the prescribed route is a source of satisfaction to the promoters of the enterprise.

Assuming that the cask followed the most direct route in its journey, I estimate that it travelled about 2,500 miles in the five years eight months and twenty-five days which elapsed. If, however, as is more probable, it followed the more circuitous routes heretofore taken in the drift of the *Jeannette* and *Fram,* the entire distance traversed from Point Barrow to Iceland would be fully 3,000 nautical miles. In view of the fact that, thus far, but one

cask has made the journey and that over five years were occupied in transit, some may question the value of the results obtained. In answer to this view of the question, it may be well to remember that doubtless other casks will be reported from time to time; and, in this connection, we should not forget the vast extent of the Arctic Ocean, which comprises an estimated area of between four and five millions of square miles, and presents difficulties of navigation not comparable to those of the temperate zone. The remoteness of the region traversed by these casks must also be considered; and it must also be remembered that, even when brought by the great elemental forces mentioned to their journey's end, they are even then in regions far from the haunts of civilized men. All these circumstances render the recovery of these messages, at best, a piece of rare good fortune.

POLITICAL GEOGRAPHY AS A UNIVERSITY SUBJECT.

BY EMORY R. JOHNSON (Philadelphia).

Physical geography has long been taught in many colleges and universities, and for some years commercial and economic geography has had a place in the curricula of such institutions. Political geography, however, has not yet been generally introduced into college and university courses. Whether the subject ought to be introduced or not depends upon its content, educational value, and relation to other courses of study.

Political geography may be defined in general terms to be geography in relation to political and social institutions. This definition contrasts political geography sharply with commercial and economic geography, which is concerned with geography as related to economic activities.

The study of political geography was introduced at the University of Pennsylvania in the autumn of 1904, primarily for the purpose of enriching the study of the political and social sciences. Experience has shown that students enter the University of Pennsylvania—and the conditions at other universities are doubtless the same—almost entirely ignorant even of elementary geography. To teach economic subjects, sociology and government, not to mention other university subjects, a knowledge of "old-fashioned" elementary geography is necessary. Of course the students need something more than elementary geography as a preparation for the

satisfactory study of government and the different branches of economics, and the course in political geography at the University of Pennsylvania has been made advanced in character, without, however, neglecting the study of general and descriptive geography.

The fact that political geography was also thought to be a study of much cultural value was another reason for introducing it into the curriculum of the university. The course as now being given is intended primarily for freshmen in the Wharton School of Finance and Commerce, but is open to election both by the upper classmen in the Wharton School and by college students generally. Several college students outside of the Wharton School have elected the course.

The scope of the subject as taught has been influenced by Mill's International Geography, which is used as a text-book. The text book, however, is not closely followed, and the instructor feels free to put into the course whatever facts of political geography that seem to him important; the course is purposely made somewhat unsystematic, the primary object of the instructor being to inspire the students to study geography not only in books but in the daily press. The instructor believes that the most important service he can perform is to awaken a keen interest on the part of the students in the affairs of the world and to influence them to acquire the habit of using an atlas and a gazetteer.

The methods followed in giving instruction have purposely been developed with reference to causing the students to learn the main facts of ordinary geography. No attempt is made to avoid the study of things that are elementary, but emphasis is laid (*a*) upon an explanation of how each country studied came to be a separate, distinct country; (*b*) upon its political institutions and the geographic influences that have affected them, and (*c*) upon the present political problems of paramount interest in connection with each of the countries studied.

The world-events of the past two years have greatly assisted in making the course interesting. This year while the class was studying Great Britain, the Irish question was agitating British politics; in the study of France, the great question of separation of Church and State came up for discussion; the interest of the class in Norway and Sweden was enhanced by the events that have led to the separation of Norway from Sweden; the Balkan Question has been at the forefront for a few months past; for two years the great Russo-Japanese war has made the study of Russia and Japan of especial interest; likewise the South African war is still a recent

event in the history of the world, as is also our recent war with Spain. Light can be thrown upon these and many other questions of world-politics by studying the geographic factors affecting them. The interest of the student in reading the papers can be greatly enhanced by this kind of political geography.

While it is still too early to state definitely the results of the study of political geography at the University of Pennsylvania, there is every reason to feel that the course is succeeding. The students seem to appreciate the subject, and the success thus far attending the course seems to warrant the continuance and development of the work.

THE PLACE OF ECONOMIC GEOGRAPHY IN EDUCATION.

By J. Russell Smith, Ph.D. (Wharton School, University of Pa., Phila.).

The phases of geography are many, and they are all interesting, but, thus far, education, particularly higher education, has neglected to recognize the fact that all human activity is run out in a geographic mould.

Earth form, earth structure, earth history, climate, and the biologic response are interesting, as are all sciences, but the bearings of these upon human welfare and activity may reasonably be expected to be of interest and use to a greater number.

As a negative pedagogical example of this, I remember a geography lesson in a German gymnasium that I visited a few years ago. It was in Leipzig. The instructor was a Doctor of Philosophy, a student of Kirchhoff and the great Ratzel, and the son of a geographer of some note. So great was the concentration of study on the Vaterland that the part of the lesson that pertained to North America was the second and last reference to that continent that came in the entire course in a classic gymnasium. In a hasty review, indicative of previous drill, the instructor had the students name the Great Lakes, Hudson's Bay, and various uninhabited lands and unnavigable waters lying to the northwestward, and then he launched into a long and vivid account of the Greenland ice-cap and Peary's recent exploits and explorations.

So far as the course of instruction was concerned, the members of that class left that gymnasium in ignorance of the fact that Canada is a veritable empire and that the United States was a world-power and had furnished comfortable homes for more Germans than lived in their kingdom of Saxony. That lesson certainly

does not represent the present tendency in American geography-teaching.

Herbert Spencer's theory of education is steadily gaining ground. For the average modern man and for the school of the future, the most fundamentally interesting thing about the geography of any land should be its suitability as a home for man. The ability to see an economic situation is often surprising by its absence, but an increasing recognition of economic factors is evident in education, in current literature and in the present interpretation of history and society. The study of the earth as a home for man has all the charm of any scientific inquiry and the other vitalizing touch of human interest. It does not involve the laying aside of any of the educational work now done. It is an extension and an application rather than a replacement. The physical geographies need to stand and be much more thoroughly taught. It may properly be said that factors other than strictly geographic affect the usefulness of a land for man. In this matter of definition, I must borrow the freedom of the writers of commercial geographies who bring into their books the discussion of products arising from geological or geographical influences alike, if they result in commercial commodities.

As I see economic geography to-day, it is the interpretation of lands in terms expressive of usefulness to man. It involves (recognized or unrecognized) the creation and use of a definition of the environment necessary for the support and development of a civilized or an uncivilized community. The student must, therefore, be as familiar with human activity as with geography. Is a region good for agriculture? To answer this the geographer must understand agriculture in its broader and its particular aspects. Is a region adapted to become a manufacturing centre? This question can only be answered rationally in the light of knowledge of the facts and laws of industry, of commerce, and the characteristics of peoples.

If this study is not held very close indeed to the goal of human usefulness, it is almost sure to become warped and twisted by some one's instincts for scientific classification. For example, it is difficult for a writer or teacher to distribute emphasis equally among ten small states and one large one which is their equal in all other respects. On this basis the United States suffers in comparison with Europe, and Texas in comparison with New England. In the text-books distant continents are prone to become small and of uniform consistency and importance. They all look alike on the map and the maps are always small. The statement or the description of the products of one political division after another is apt to

be deadening and bewildering. The study of commodities has the danger of running away into classifications which destroy emphasis and render it impossible for any but the most mature to grasp the fundamental economic importance of some things and the fourth-rate and incidental bearing of others upon the vital question—the maintenance of human society.

Economic geography is not a modification of geography, the science of the earth, or of economics, the science of wealth. It is not a mixture composed of scraps or pieces of each. It is an alloy, produced by the fusion of the two into a harmonious study, with a view-point of its own, the economic interpretation of lands, the definition, the quality, and the distribution of the environment for human communities.

In economic geography, resources become almost as important as products, because the resources of to-day make the industry of to-morrow. In the recognition, explanation, and proper estimate of resources lies the kernel of economic geography. Economic progress depends upon the better utilization of the resource now in use and upon using to-morrow something which becomes a resource through to-day's discovery.

The best statesmen and business men must alike foresee and prepare for future developments. Economic geography is the part of education to point the way to this future and equip the citizen to take advantage of it. He cannot be equipped to foresee all changes, but he can be equipped to see the general trend and be prepared to keep himself informed if need be.

The phenomenal material development of the United States since the Civil War is often attributed to the fact that some four million men were marched around over the country and became acquainted with its resources. This learning was accompanied by the killing of nearly a million of the men and the wasting of billions of treasure. Cannot the geographies of this day teach the rising generation more easily and economically?

The science of economics, dealing with wealth, is a shaft without a pedestal unless there is first acquired the understanding of the primary conditions of production that is to be obtained by a study of economic geography. As economics is now becoming a part of most college courses, there is required for its proper background and its proper comprehension a previous study of economic geography.

THE ORGANIZATION OF SCHOOL GEOGRAPHY.

By Richard E. Dodge (New York).

The organization of geography for elementary schools so that it will be strong educationally and geographically is one of the most difficult problems that confront a worker in educational geography.

The possible scope of the work is as comprehensive as the science of geography itself. Hence the necessity of choosing such topics and facts as will be of most value to the youthful students and give them the best training in the subject and in the ways of studying geography. The work must be arranged year by year so as to be within the scope of the pupils' mental abilities, and must be of such a character that a pupil will have gained something of permanent usefulness no matter at what time he leaves school.

Just as in a well-ordered chapter in expositional writing each paragraph must be based on the preceding paragraphs and lead up to the succeeding paragraphs, so the work throughout the grades must be based on that which has gone before and lay a foundation for that which is coming. While the work of the course as a whole must be a unit, each year's work must also be a unit, as, indeed, must each lesson.

The task of the organizer of a school course in geography, therefore, is—first, to decide what pupils should gain from their school work in geography; second, to see that this work is good geography at every step, so that it will be approved by geographers; third, to arrange the work so that it is strong educationally; fourth, to bear in mind that regional geography must be taught early, because so many pupils leave school at the end of the fifth or sixth year; fifth, to see that the best training in the methods of studying geography is given in each year; and sixth, that the work of any grade must not be overturned in later years.

This applies particularly to generalizations and definitions. A definition must *define,* and must be a summary of the points previously presented on a special topic. It must be of such a character that it can be built upon as the years go on without any necessity of relaying the foundation gained in the earlier years of work.

Good geography and good teaching demand that the work should proceed from the near and familiar to the remote and unfamiliar; that certain of the continents should be studied twice, but from different points of view; that training be given in the reasons for things at every step; that the work in the higher grades should be from causes to consequences; that enough knowledge of facts be

given to make the general principles clear and have pupils sufficiently acquainted with places in the world to be able to understand current events, and that pupils should know how to gain more knowledge of geography as the years go on after they leave school.

Courses of geography arranged to exploit a certain method of teaching are not as strong geographically or educationally as courses arranged to give the best training in the science, the method to be employed in teaching changing according to the mental nature of the pupils.

It is, therefore, the task of the scientific geographer to organize the work as a whole, so that it will give the best training in the subject and the methods of teaching the subject, for no one can outline the scope of school geography unless he sees clearly the part that school geography should play in laying a foundation for further study of the subject in the higher institutions or private life. It is the task of the superintendent or supervisor, within the limits set by the geographer, to arrange the work so as to be best adapted to the pupils' abilities and best related to other subjects in the curriculum. It is the business of the teacher of any grade to have her work in geography based on the previous work, and lay the best foundation for the next higher year's work, while she adopts a method of teaching that will give her pupils the best training in methods of study. The teacher must remember that she is teaching children, and that geography is but one of the many subjects involved in their training. A teacher who has in mind simply the science may fail to give her pupils the best training possible, while one who has in mind merely the principles and methods of modern education may not give sufficient attention to the subject as a subject.

SOME REMARKS ON THE USE OF TOPOGRAPHIC MAPS IN THE SCHOOLS.

BY MARTHA KRUG GENTHE (Hartford, Conn.).

*Abstract.**

It is desirable that the use of the topographic maps should be taught in the elementary schools, because a great proportion of the pupils never get more than an elementary school education. The best time for the work is the last school year, because then the map work can be utilized to review, from new points of view, the sub-

* The substance of this paper having been published in full before (Jour. of Geogr., May-June, 1905), only an abstract is given here.

stance of the earlier studies, and also because it must be preceded by the more elementary forms of cartographic representation in the course, which must prepare the way for this most scientific cartography.

The stages of preparation are (*a*) the study of topographic features in nature and their reproduction in the sand pan; (*b*) the study of "relief" maps (see Frye's geographies) as pictures of such sand models, showing *where* things are, instead of the things *themselves;* (*c*)the study of school maps on the international colour scheme (see the "Natural," and Dodge's, geographies). By colouring an actual relief in different shades corresponding to the heights, and transferring the colours to a "relief" map, the transition from the pictorial expression of the latter to the more conventional of the new stage can be easily made without overtaxing the child's power of abstraction.

Children who are familiar with the international colour scheme can be introduced into the understanding of the contour map with little difficulty if at the first presentation of the latter (for which the home sheet ought to be selected) the contours on the same appear coloured, so as to present a difference of *grade* only, not of principle, in comparison with the maps to which the child has been accustomed. The child then sees the same kind of map as before, only more differentiated, and must learn to read from the ten or twenty shades of the coloured contour map the elevations above sea-level as easily as he has done before from the five or six shades of his text-book map. Then the idea of showing only the *boundaries* of the areas of equal height must be brought before him, and a reproduction of the same map presented which shows only those contours that had been used as colour limits (each 100 ft., or even 200 ft., according to the relief or scale of the demonstration sheet). After the contour idea has thus been established in the child's mind, the possibility of a more detailed application of the same can be suggested, and thereupon the real contour sheet is presented.

After this, exercises in the practical use of the map must be made; measuring of distances, and calculating the time it would take to walk, or to ride, over them, and letting the child compare the result of the calculation with actual experiences; drawing the outlines of hills and mountains from the contours in the shape of sections, by transferring on paper both distance and elevation, on the scale of the map. It may be necessary at first to use the tenfold elevation, since on the 1 mile=1 inch scale 250 contours would have to be crowded on the space of a vertical inch, and no more than 25 can be

accommodated there with any chance of accuracy; but in this way the child will learn how much we must abstract of the heights of most mountain profiles, and part of the section, if not all, must then be enlarged either to the 10 inches=1 mile size of the vertical scale, or, perhaps, the latter reduced and the horizontal scale enlarged to an intermediate 5 inches=1 mile scale. Arithmetics can here co-operate very well with geography. Finally, a model made from cardboard of which no more than 25 sheets make a vertical inch, by cutting out each contour interval along the contour line and pasting the slices of cardboard on each other representing the different layers, so to speak, of elevation, will produce a plastic model of a mountain, not too much overheightened, which will demonstrate to perfection the relation of contour to elevation. Seen from above, it looks exactly like the corresponding part of the contour map, and the child can see that steep slopes appear as a crowding of contours, that contours wide apart correspond to gentle ones, that valleys coincide with lobe-shaped parallel contours, etc. The study of the home sheet thus accomplished, other sheets whose objects may not be familiar to the children are taken up and interpreted by them.

Where no sheet of the home district is available, the contour map of the United States published by the Geological Survey, which is published both coloured and uncoloured, may be chosen for the first exercises, and the later ones done on any other characteristic sheet with well-defined topographic features.

Information on the work of the U. S. Geological Survey and how to obtain its publications should conclude this course.

MAP STUDIES FOR ENGINEERING STUDENTS.

BY DOUGLAS WILSON JOHNSON (Boston).

Abstract.

This paper presented an account of certain methods employed in giving instruction to engineering students in the subject of physiography. The object of the work, as stated, is to make the engineers so familiar with the different land-forms and their origin, and their representation by contours, that whenever they see a contour map it will have the fullest possible significance to them; whenever they use a contour map they will know at sight with what special types of hills, valleys, etc., they are dealing; and whenever they make a contour map they will work intelligently, producing an expressive, well-proportioned, significant representation of the earth's surface.

To accomplish this object, three things are essential: (1) The student must know the appearance of land-forms as we find them in nature, so as to be able to recognize them readily. (2) He must know the appearance of the contour representations of those same forms as we find them upon the map, so as to be able to recognize them there and to reproduce them on maps of his own. (3) He must understand the origin of those forms, the history of their evolution, their past and future changes; for only thus can he fully appreciate their significance.

To familiarize the student with the appearance of land-forms in nature, field excursions are taken, which also afford an opportunity for the correlation of a number of topographic features with their contour representations. In this way the student gets a first-hand acquaintance with a certain number of forms, and learns to read contours to the extent that he acquires the means of obtaining a second-hand acquaintance with other forms which he cannot visit in the field.

The use of photographs and lantern-slides aids the student in broadening his acquaintance with the features of the earth's surface. The correlation of the actual appearance of these features and their representation by contours being of prime importance, it is found important to mount photographs of typical land-forms, together with contour maps of those same forms, in frames, which may hang upon the walls of laboratory and lecture-room. On the lantern-slide both the photograph and map may be shown together, so that one is able to compare the photographic and contour representations of the same feature at a glance.

A most important part of the work consists in the detailed study of a large number of maps representing the more important topographic features of our country. For this purpose over three thousand of the U. S. Geological Survey's contour maps, mounted on cloth, were classified according to the features represented by each, a sufficient number of duplicate sets being furnished to supply a laboratory section of convenient size. After studying these maps to learn the characteristic features of each, the student is required to draw ideal contour maps representing the essential elements of a stated number of the more important forms. In the lectures which accompany the laboratory work, the questions of origin, development, and classification of land-forms are considered.

COMMERCIAL GEOGRAPHY FOR SECONDARY SCHOOLS.

By J. Paul Goode (Chicago).

Abstract.

Commercial geography, one of the youngest claimants for attention in the school curriculum, is a great field, widely recognized, but in this country essentially unorganized. In the subject as we have it presented there are two well-defined points of view—the commodity and the country. Difficulties begin in trying to limit the field, to determine what *is* the geography of commodities. The question raised as to processes; they have a right to enter, if they have a geographic bearing—for example, the ring spinning machine, in its relation to the rise of cotton manufacture in the lands where the cotton is produced.

For secondary schools the practice is challenged of trying to cover the earth twice; from the point of view of commerce, and also from the point of view of the country, the country as the unit in elementary work being illogical—for commerce in inter-regional—and the conditions of production and transportation are mostly physiographic. We are attempting to do too much in a year. It would be much wiser to leave the country as the unit of treatment to advance study, and make the elementary course deal with commerce and commodities. An analysis of such a course offered. For the presentation, the prime requisites of the teacher looked into, also the character of the text-book. The current school text criticised as too condensed, with a tendency to compilation of unrelated statistics, and to a lack of real geography.

The value of the study emphasized, as compelling research and the use of the library; and especial attention called to the value of our Government publications. The great value in class demonstration of maps and graphs, as also the significance of the lantern, particularly in the study of maps. The significance of the museum as auxiliary to library and class-room, and the good work of the Philadelphia Commercial Museum along this line. The excursion to mine and factory considered as an instrument of instruction.

HOME GEOGRAPHY.

By F. P. Gulliver (Norwich, Conn.).

It is now pretty well agreed among educators that the study of geography should be commenced by obtaining a clear understanding of the local surroundings of the school. From a careful study of

the home region, pupils may be led in ever-widening circles to a rational conception of the whole world. It is impossible, of course, for each pupil to observe many of the facts of geography which an educated man should know. A few more favoured pupils will have travelled several hundred miles, and will thus have been able to observe the geography of a city, a village, and the country, and they may easily be led to compare the conditions in which men live in contrasting localities.

The great mass of pupils, however, seldom go far from their own homes. It is a well-known fact that there are many children living in New York City who have never seen the elevated railroad, and there are many grown people in country districts in the United States who think that you are telling them some fairy tale when you describe the conditions in New York which have led to the building of a railroad above the level of the streets. There is no doubt that a great many statements in our ordinary geographies are worse than myths and fairy tales to many pupils who read the books, and even to some of the teachers who are trying to teach them.

The most scientific method of beginning the subject of geography is to observe with the pupils their immediate surroundings, and, after studying these, to lead their minds to a rational comprehension of the facts of other parts of the world. Through a study of the school grounds, the streets, the highways, the railroads, and the steamship lines leading out from the home the pupils may be made to realize something of the relative size, position, and importance of other cities in distant countries in the world at large.

Maps of the schoolroom, the school grounds, and the home city or village should be constructed by the pupils before maps of more distant regions are shown. Only after pupils fully realize that a map means some definite portion of the surface of the earth, which may be seen and passed over by man, can they wisely study and intelligently comprehend maps of other parts of the world.

A study of the local plants and animals will lead to a rational understanding of plants and animals in their relation to man. It is not necessary that an exhaustive study should be made of all the plants and animals which surround any school, but by a wise selection of certain plants and animals, to be studied minutely, the pupils may be led to understand later the larger facts of life which are of such importance in the distribution of man on the face of the earth. A large proportion of the facts learned in regard to life histories of local plants and animals are true in regard to plants and

animals living in more distant parts of the world. Therefore, the study of the plants and animals near the school is an important part of the early training in geography.

Accurate observation is the most important fundamental principle in scientific training, and there is probably nothing better than this study of plants and animals to teach pupils how to observe. Much of the time spent in the observation of nature might be made more valuable as a part of the geographic training of early years. By a comparison of local plants and animals with those of more distant regions, the facts which the pupils know from their own personal observation may be used to increase their knowledge and understanding of the larger geographic relations of living forms.

The first introduction of the pupil to history belongs also with the study of home geography. The facts controlling the physiographic location of settlement, and the development of cities in favourable locations are closely interwoven with the local history. Therefore a brief study of the historical development is a fundamental part of home geography.

By detailed studies of the home productions and industries, pupils may be led to understand the great facts which control the business and commerce of the world. When a few mills, stores, mines, etc., have been studied in detail, and the facts in regard to them made part of the students' personal knowledge, the facts in regard to other regions are more clearly comprehended by a comparative study of the home products with those of other regions. Thus interrelations of men in the country and the city, in the mountains and on the plain, on land and on sea, are made clear to the minds of pupils.

From a study of the shipping of some agricultural product or manufactured article the great facts in regard to transportation are easily understood. Thus study of lines of commerce may take the place of actual journeys, and, by following on maps these routes along which shipments of local products take place, the pupil will be led to a knowledge of the surrounding country, and finally of more distant parts of the world.

PRACTICAL EXERCISES IN PHYSICAL GEOGRAPHY.

BY PHILIP S. SMITH (Cambridge, Mass.).

Abstract.

In order to make laboratory work disciplinary and instructive, it is evident that exercises should be specific. To give this quality, it

is necessary that all students should be working on the same material at the same time. It is desirable that all extraneous matter should be eliminated, so that the student's attention will focus on the fundamental features. The Government maps, excellent as many of them are, present such a wealth of detail that the characteristic forms are often masked.

It is the duty of the modern physiographer not only to describe the character of individual land-forms, but also to determine their relation to the series in which they belong. Therefore, maps for laboratory work should show the same region at different stages of development.

Owing to the fact that large-scale maps do not bring out the essential characteristics and do not show successive stages of development, it has seemed advisable to prepare diagrammatic maps and sketches. In conducting an exercise with these diagrams, the student is given three sheets. The first, completed by the instructor, shows a land-form in different stages of development. The second sheet shows the same type of land-form as the first, but has the various topographic features differently distributed and the critical points left blank. The third sheet contains any instructions that are necessary, and also questions referring to the maps on Sheets I and II. The exercise consists in studying the completed figures, answering the questions, and filling in the blank spaces on Sheet II.

After a student has completed one of these exercises he is then ready to study topographic maps of the same kind of land-form, for he has a type to which the variations and similarities of the actual field examples may be referred for comparison.

The use of diagrammatic maps for laboratory work seems to have the following advantages over the older method of using only large-scale topographic maps:

It omits unessential details.

It obviates mere mechanical copying.

It trains the student both in verbal and graphic description.

It holds the student's attention closely, for it increases the specific quality of the questions.

It stimulates the consideration and application of physiographic principles.

THE PRESENT CONDITION IN OUR SCHOOLS AND COLLEGES OF THE STUDY OF CLIMATOLOGY AS A BRANCH OF GEOGRAPHY AND OF METEOROLOGY AS A BRANCH OF GEOPHYSICS.

BY CLEVELAND ABBE (Washington, D. C.).

Ever since the beginning of the publication of the daily weather bulletin of the Cincinnati Observatory I have not failed to urge that meteorology be taught in our schools, colleges, and universities as a department of knowledge of importance to every one, as tending to dissipate superstitious ignorance, and as stimulating the interest of those who may have a slight natural tendency to devote themselves to the advancement of this difficult study.

At that date Loomis's text-book was used in a few colleges; in others some remarks on meteorological phenomena were made in connection with text-books on chemistry, physics, astronomy, and physical geography. In fact, the sciences were not taught then as they are now. It was in 1882 that I gave the students of our Normal School in Washington some talks on methods of teaching meteorology as a part of nature-study, and prepared a form for the use of the pupils of the lower classes of the graded schools, who should keep their own daily weather records and discuss them in a popular, logical way. The principal of that Normal School, Miss Lucilla E. Smith, subsequently carried the same idea to the teachers' Training School of Brooklyn, where it has not ceased to bring forth good fruit. But the great pioneer in school and college work was our colleague Prof. W. M. Davis, who made his elective courses for the freshman class of Harvard so thorough and so attractive that they became the ideal model for all others. The influence of the Harvard school of meteorology has been felt everywhere, especially, of course, where its graduates have established other centres of instruction.

Although the officials of the U. S. Weather Bureau have but little time or opportunity to devote to teaching, yet they have improved every occasion to promote this good work, as being the best method of securing an intelligent popular appreciation of the great problems of weather prediction. Some of us have been able to give lectures of a very technical character for the benefit of the most advanced students, but most of us have gone to the smaller colleges and to private and public schools, where we could reach the mass of the people; here we have explained the weather map and the work of the Weather Bureau.

The reports from our stations show that during the past year work of this kind has been done by about 100 of our observers, sec-

tion directors, forecasters, and professors, showing that to this extent the interest in the subject is quite uniformly distributed throughout the United States. All wish to know something about the subject. At almost every Weather Bureau Station many lectures or talks were given during the year. In fact, in each locality many schools and colleges are studying the subject, and the lectures by our observers merely constitute small incidents in the courses of instruction.

We are making a fairly complete collection of statistical data relative to the present state of meteorological instruction, and, so far as at present heard from, an estimate may be made which will give us the following general results:

About 1,000 *graded schools* teach the elements of climatology as a part of geography, receive the daily weather maps, and give talks upon their use in forecasting the weather. About 7,000 *high schools,* or seven-eighths of the whole number, teach the elements of meteorology and climatology in connection with physical geography or physical geology.

The replies to a circular letter recently sent to 177 public normal schools in the United States indicate that in about 25 meteorology and climatology are taught in specific courses, in about 115 these subjects are taught in connection with physical geography or some other allied subject, and in the remaining 37 these subjects are not touched upon.

As to colleges and universities, out of 245 replies 49 state that they have specific courses in meteorology, 95 teach meteorology in connection with some other subjects, and 101 pay no attention to the subject. The corresponding percentages are 20, 39, and 41; probably the replies from other colleges and universities will not alter these ratios very much.

These numerical statistics show that attention to our science has been awakened: in fact, it is receiving a steadily-increasing amount of recognition. In fully one-half of these institutions, from the lower schools to the higher universities, some form of laboratory method is pursued—that is to say, students are required to make personal observations, experiments, and deductions. They study the daily weather map and develop habits of individual thought. In a matter that is so complex as the weather, no text-books can replace the daily map, personal observations, and independent study.

Concerning meteorology as a branch of mathematical physics, I believe that the courses given to graduate students at George Washington University by my colleague Prof. F. H. Bigelow and myself

are as yet the only effort in that line; but the subject is so attractive and important that we must hope that others will take up this very promising line of work.

MAP-MAKING IN THE UNITED STATES.

By Cyrus C. Adams (New York).

Abstract.

Our map houses have not reached the stage in which first-rate production is possible. There are good reasons why this so. The best map of a region cannot be made unless it is based upon a thorough topographic survey. These surveys are almost invariably made by the Governments, because they are too laborious and costly for private enterprise. It is in those countries whose Governments have been most energetic in providing scientific surveys of their domains that private map-making has been most developed and is producing maps of the best quality. But it is only within a few years that our Government survey has covered areas so large that the topographic sheets might tend to encourage the establishment of map houses with the best cartographic appliances and conducted under strict geographical supervision.

Young map firms expect to base success upon the patronage of their countrymen, whose demand is chiefly for maps of parts of the home territory or of all of it. But we have not possessed the good surveys upon which to base good maps; hence there is only beginning to be an incentive for commercial map houses to develop superior map establishments in our country.

The existing map houses do not seem to be able to deal adequately with the better map material. We need not wonder at this. We have no schools in which young men may cultivate natural talent in this direction. Some surveying for map-making purposes, some plane-table work, are taught in the Yale Forest School, some similar work is done at Cornell and possibly at one or two other institutions; but we have really no schools in which a person may acquire technical and scientific training in the theory and practice of cartography in its present development.

On the other hand, in the German-speaking countries of Europe, there were in progress, during the summer semester, this year, cartographic courses in seven of the universities and higher schools; and this winter the subject is being presented in nine of these institutions. Similar facilities are greatly needed in our country.

The plea of some map houses that the public wants nothing better and will pay for nothing better than the maps they provide is not valid, for we have witnessed the embarrassment to which publishers of text-books and works of reference have been subjected by purchasers who do not accept without protest maps that are misleading. There is in New York more demand than supply for persons having the knowledge, facilities, and time to revise the finished work of the map firms, the publishers believing it to be necessary to incur this additional expense.

There are encouraging features. Our map-makers are not insensible to criticism. They are now less lavish and indiscriminate in the use of colours. Many black-and-white maps are excellent, especially if publishers incur the expense of having them revised before the plates are cast. The students in some training schools for teachers and in many of our class-rooms are becoming familiar with better and more accurate maps, many of them of foreign origin.

Many geographers have voiced the same idea that the late Sir William Wharton expressed in August last, when he said: "Good maps are the foundation of all sound geographical knowledge." Good maps bear some such relation to geographical study that tables of logarithms do to computation. They are economizers of time and of labour. As objects of artistic and ingenious workmanship, they gratify the æsthetic sense; as expressing graphically a wide range of scientific fact and its approximations, they lighten in many ways the labour of accumulating data. Dr. Hermann Wagner has said that from his study of maps he derived a large part of the material for his great work on geography. Upon what basis more inspiring, suggestive, and informing may we ground a study of the Galla Lands of Africa than upon Carl Schmidt's recent map showing the seventeen routes of explorers since this large white space was entered in 1888 and the records of geographical and ethnological discovery along these routes, here assembled on one sheet?

From such progress as we have made in the concept of geography, in methods of teaching and utilizing geography, it is only natural if we infer that some day we shall supply our own maps. Every geographical worker and teacher may help to hasten this day. Trained teachers should know how they may enliven and enrich their school work with good maps. In the training schools they should know about those atlases that are not expensive though among the finest of map products, such, for example, as the Sydow-Wagner School Atlas, which would be an inspiration in their daily

work. The pupil who begins to appreciate the difference between orographic features, shown meagrely by rough hachuring, more or less haphazard, and the scientific expression of them on good maps is acquiring an appetite for good things.

Many geographers require frequently to have maps made. Even though they may not have the technical skill of the trained cartographer, they will be helpful if they give the map-maker the best materials and insist upon at least an approximately adequate expression on the plates of the information desired. Some very good work has appeared, especially in the later text-books, by means of geographic supervision outside the map houses.

Our map products should be described by writers who review them in publications for just what they are. Mistakes may be excused or leniently dealt with; but error that is habitual, characteristic, and glaring, the fruit of carelessness, indifference, or ignorance, will some day be tolerated no more in our maps than in our textbooks.

Our geographical magazines should consider it a pleasure to commend what is good in our maps and a duty to point out that which misleads. Every geographical society should set its cartographic standard high, and maintain it, even though compelled to go far for its maps.

If the influence of geographers and educators can prevail with Congress to place maps and map plates with English nomenclature on the free list when the tariff schedules are revised, it should be exerted. It will be time enough to put a duty on these products when we have in our country a few such masters of map-making as Ravenstein, Scobel, Fischer, and Schrader, and the experts of the Gotha and Edinburgh houses to build up what would truly be an infant industry.

Perhaps organized effort and a show of doing things through some society would not be a wise procedure; but this Association should keep map improvement in view, and be operative through its Council at all times, so that if circumstances arise when its influence, or the concerted influence of all the geographical organizations of the country, may properly be exerted, the helpfulness of the Association may be fully enlisted.

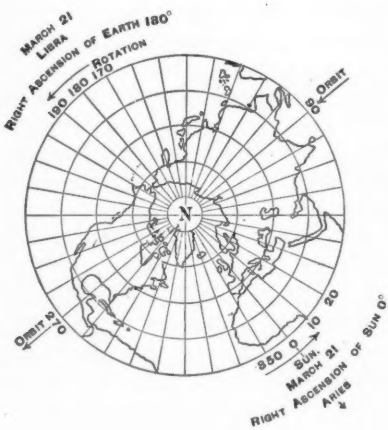
Good maps always in the schoolroom and reiterated insistence upon this reasonable requirement—good quality of our map products—will tell at length in the introduction of better plants.

A MODIFIED POLAR PROJECTION ADAPTED TO STUDIES IN DYNAMIC METEOROLOGY.

By Cleveland Abbe (Washington, D. C.).

The maps of the globe on which the climatologist usually exhibits the general features of the condition of the atmosphere are either the Mercator projection, which is more properly called a development, or the various forms of stereographic, equal surface, and polyconic projections.

A polar projection showing the isobars, isotherms, and winds of the northern hemisphere was, I think, first used by the Signal Service (1875) in connection with its publication of the "Bulletin of International Meteorological Observations Taken Simultaneously at 12h. 43m. Greenwich time." This was, however, an arbitrary projection, in which meridians were represented by radial straight lines and parallels by concentric equidistant circles; therefore, angular longitudes and latitudes were not distorted, but areas and linear distances and angular bearings or azimuths were subject to a varying distortion.

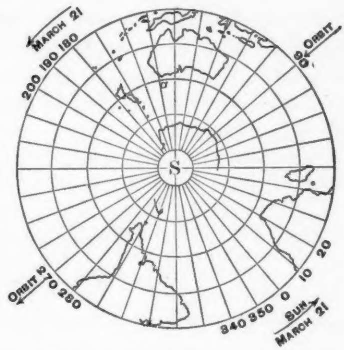


Whatever polar projection we adopt to suit the needs of a special problem, there is one feature that is common to them all—one that may be of little importance to the cartographer, but which is of fundamental importance in relation to all motions, and especially to the dynamics of the atmosphere—viz., the direction of the rotation of the globe.

The northern and the southern hemispheres rotate together around the earth's axis in the so-called positive direction; it is therefore very important that this rotation should be presented to the mind of the student correctly. It is highly embarrassing and confusing to use the ordinary polar projections in which the northern hemisphere is depicted as seen from above the North Pole and the southern as seen from above the South Pole. This causes a reversal of the direction in which the rotation is counted,

as though the two halves of the sphere were revolving in opposite directions. Our atmospheric and oceanic currents, and even our earthquake phenomena, depend on the uniform direction of rotation.

I have therefore prepared and used two polar maps as seen from above the North Pole only; the globe may be considered to appear transparent or both hemispheres may be supposed projected simultaneously on the same equatorial plane. The maps are to be superposed as if printed on the right-hand pages of two successive leaves, so that the centres and the similar meridians of the Southern Hemisphere shall be directly below those of the Northern Hemisphere. The angular rotation on both maps is in the same direction, as shown by the arrows. The numeration of angles continuously from 0° to 360° in the outside circle is, strictly speaking, not a numeration of longitude but of angular motion. The numbers are not supposed to be attached to the revolving globe; they belong to a stationary framework, outside, and serve to show the position of the Greenwich meridian at any moment after Greenwich mean noon. The lines 180°-N-0 and 180°-S-0° pass through the sun on March 21st, toward Aries and the zero of astronomical right ascension.



This arrangement has several advantages:

(1) The temperature, pressure, and winds at the outer edge of the Northern map are coincident and continuous with those immediately below on the outer edge of the Southern map.

(2) The equatorial tendency of a moving body is toward the right hand in both maps.

(3) The circulation of the air in the lows is the same in both maps—*i. e.,* the same as that of the globe itself; in the highs it is, of course, opposite thereto.

(4) The disturbance of the ideal planetary circulation by the influence of continents and oceans is beautifully brought out, and especially the contrasts between the northern land and the southern water surfaces in similar latitudes.

(5) An especially instructive laboratory experiment consists in establishing models of the Northern and Southern Hemispheres analogous to these polar maps upon the same vertical spindle, the

southern map being at a convenient distance below the northern map. An equatorial rim is supplied to each, so that water may be introduced—shallow (to represent the ocean) or deep (to represent the atmosphere). A slow, uniform rotation is given to the spindle; a moderate heat is applied below the ocean or the continents, and the local circulation is shown by little floats. Although this is not a perfectly analogous mechanical representation of the earth and atmosphere, yet it seems to lead the student up to the true problems of meteorology as studied in the light of Helmholtz's principle of dynamic similarity.

PROOF OF THE EXISTENCE OF THE UPPER ANTI-TRADE AND THE METEOROLOGICAL CONDITIONS AT LESSER HEIGHTS IN THE NORTHERN TROPICS.

BY A. LAWRENCE ROTCH (Blue Hill Meteorological Observatory, Massachusetts).

It has generally been believed that the trade-winds which blow towards the equator there rise and flow polewards above the trade-winds, as southwest and northwest currents in the northern and southern hemispheres, respectively; but there has been no proof of this theory, excepting observations of the drift of high clouds and of volcanic dust and a few wind observations on tropical mountains. These observations, however, are most scanty in the region of greatest interest—namely, over the Atlantic, where two years ago the thermal and hygrometric conditions prevailing in the free air above the trade-winds were also entirely unknown.

The exploration of the atmosphere in the trade-wind region of the Atlantic by the use of kites was first proposed by the writer at the Glasgow meeting of the British Association in 1901, in consequence of his successful experiments made during a voyage from Boston to Liverpool which demonstrated that, with a vessel navigable at will, meteorological data could be obtained with kites independently of the natural wind. In order to organize such an expedition to explore the tropical atmosphere, applications for aid were addressed to the Carnegie Institution and to the Prince of Monaco, but in both cases without receiving the desired help. In 1904, however, Professor Hergesell, President of the Commission for Scientific Aeronautics, succeeded in interesting the Prince of Monaco in the scheme, and upon his steam-yacht the *Princesse-Alice,* during the summer, sixteen kite-flights were made above that part of the Atlantic bounded by Spain, the Canaries, and the Azores. Although a

height of nearly 15,000 feet was reached, the southwest current, which should correspond to the theoretical anti-trade, was never encountered. From the fact that the kites frequently exceeded in height the Peak of Teneriffe, Professor Hergesell concluded that the southwest winds, which have been observed on this mountain, are due to the influence of the island, and that the exchange of air takes place through the northwesterly currents which he observed. These astonishing conclusions led M. Teisserenc de Bort and the writer to organize an expedition for the purpose of testing Professor Hergesell's results. Upon the *Otaria,* a fast steam-yacht purchased by M. Teisserenc de Bort, M. Maurice of Trappes Observatory and Mr. Clayton of Blue Hill went during the months of July and August, 1905, from the Mediterranean to latitude 9° North, *via* Madeira, the Canary and Cape Verde Islands, returning to the Azores. To attain a greater height than was possible with kites, paper pilot-balloons were provided, which, after being filled with hydrogen, were liberated from the islands mentioned, and their drift at increasing heights was measured from the ends of a base-line on the shore. One balloon provided with self-recording apparatus was launched from the boat off the island of Palma (Canaries), but it was not recovered. Such observations from instruments carried by kites were, however, obtained over an extensive region. Sailing from Boston on the White Star steamer *Romanic* in June, 1905, Mr. Clayton executed, on the voyage to Gibraltar, six kite-flights to an average height of about 3,000 feet. There he joined the steam-yacht *Otaria,* and, with the assistance of M. Maurice, seventeen kite-flights were made over the open ocean, besides two in the harbour of Santa Cruz (Teneriffe) to investigate the sea-breeze. In this way continuous records of barometric pressure, temperature, humidity, and wind-velocity were generally obtained from sea-level up to the highest point reached by the kites, which was 7,500 feet. Direct eye-observations to a still greater height were made by Mr. Clayton upon the Peak of Teneriffe, and to a lesser height upon the Peak of Fogo (Cape Verdes).

The atmospheric circulation was found from these observations to be as follows: (1) North of Madeira and near the Azores the upper winds, as was already known by observations of clouds, are chiefly from W. and N.W., this region lying to the north of the barometric maximum over the ocean and beyond the trade-wind zone. (2) The winds blowing toward the equator are from N.E. to E. in the region below half a mile, and generally from N.W. to N.E. throughout a region extending to a height of two or three miles. (3) The return current from the equator, or anti-trade, is

formed by winds having a southerly component, being generally S.W. in the latitude of the Canaries and S.E. near the Cape Verdes, these winds having been observed at both places by balloons up to a height of seven miles. From the observation of clouds and volcanic dust it was already known that the east wind in the vicinity of the thermal equator extends very high. Notwithstanding the great thickness of these currents their density is necessarily small. The change in the direction of the upper winds from S.E. to S.W., in going north from the equator, is caused by the earth's rotation.

The thermal and hygrometric properties of the atmospheric strata up to a height of three miles are these: (1) In the surface trade, which blows with a moderate velocity from N.E., the temperature decreases at the adiabatic rate in nearly saturated air. (2) Above the surface-wind is a calm belt, in which the temperature is higher and the humidity much less than it is in the lower stratum. Above the plane of inversion the wind comes from a direction to the left of the lower wind, when facing it, and blows with a greater velocity. (3) The third stratum, beginning at a height of two or three miles, which moves rapidly from the E. in equatorial regions and from a general southerly direction between latitudes 15° and 30° North, is potentially warm and has a low relative humidity, although clouds float in it. A rise of temperature occurs at the junction with the intermediate current.

The decrease of temperature with increasing height on the northwesterly slope of the barometric maximum near the Azores is quite different from that on the southeasterly slope, the former region having a comparatively slow decrease, at least up to the height of a mile, whereas in the latter region the temperature falls at the adiabatic rate up to the level of the cumulus clouds (a height which varies from day to day but averages, perhaps, half a mile), where there is a decided inversion of temperature.

The vertical distribution of temperature and humidity first stated does not differ materially from that found by Professor Hergesell during the cruises of the *Princesse-Alice* in 1904 and 1905; but his last observations, which were made with balloons carrying to a greater height than the kites' self-recording instruments, still fail to show, except in two cases, the existence of the upper current from a southerly direction. Since Professor Hergesell expresses his belief that the results obtained by the Franco-American expedition were influenced by the proximity of the African continent or the islands, its promoters are about to make observations from the *Otaria* to the west and south of the regions already explored by them.

NOTES ON THE MISSISSIPPI RIVER FLOOD OF 1903 AND ON THE FLOODS OF OTHER YEARS.

By Robert Marshall Brown (Worcester, Mass.).

Abstract.

Great floods are not experienced annually. They occur at greater and not regular intervals. The springs of 1882, 1897, and 1903 were seasons of notable floods. There is no periodic recurrence of great floods, as far as can be ascertained. The floods of the springs of 1897 and 1903 were almost duplicated in height by the floods of 1898 and 1904.

The tendency in flood calculations is not so much to compute when a great flood may be expected as to approach the stage to which the waters are liable to rise.

The waters which throw the river in flood are not drawn from the entire extent of the Mississippi Basin. The tributaries are in flood in different months. The ordinary sequence of floods is, first, an Ohio flood from the rainfall of the Southern Appalachian type in February and March; then the Upper Mississippi, followed by the Missouri.

It is not uncommon for the floods of the latter two to unite. These three rivers yield 63 per cent. of the total discharge of the Mississippi. The remaining 37 per cent. is divided among the other tributaries. The St. Francis, White, and Arkansas Rivers, draining the Ozark plateau, contribute about as much water as the Missouri. The other rivers are too small or too near the mouth of the Mississippi to be dangerous. All these rivers have never been known to be in extreme flood at once. Such a coincidence would produce a discharge of more than 3,000,000 cubic feet per second—twice as large as has ever been observed. The value of this succession of floods is enormous. On the fact of it depends to a large degree the protective value of the present system of levees. It is beyond the bounds of probability—although we must admit with apprehension not beyond the limit of possibility—that a flood may be experienced much greater than any of the excessive floods of the last hundred years.

A flood tends to lose its power as it goes down stream, and in a long river there is a small chance of a disastrous flood in its lower reaches. The flood-crest rises above the general level of the swollen stream. From the crest the water will have a movement forward equal to a normal flow because of its cross-section and the slope plus the impetus due to gravity dependent on the height of the crest. On

the other hand, in the up-stream portion of the flood-crest the water must move on a less inclined slope, and a retardation of the waters occurs. Thus the forward slope of the flood-wave tends to spread over an ever-increasing space as it progresses; and if the river is long enough, the flood-wave will suffer thereby self-destruction. The flattening of the crest by a down-stream progress is partly shown by the differences between the high and low water stages at various stations.

The movement of this crest down stream is not uniform. The hydrographs of the lesser as well as the greater floods show no great disparity of time between the arrival of the crest at Arkansas City and Greenville, forty miles below. In fact, the hydrograph of the 1903 flood seemed to show that the flood-crest arrived at Greenville at nearly the same time as at Arkansas City. If there is any difference, it is in favour of the crest arriving at Greenville, the down-river station, before it reached its highest stage at Arkansas City. In the same connection the figures of the height of crests at these stations during the 1903 flood and the previous highest recorded flood are used. The difference between the height of the crests in the latter flood, at Arkansas City and Greenville, was 5.15 feet; between Greenville and Lake Providence, 2.21 feet—a drop of 5.15 feet in 40 miles and 2.21 feet in 64 miles. There are no tributaries to the trunk stream in this distance. In the 1903 flood the figures read a decrease of 3.9 feet in 40 miles to 2.7 feet in the next 64 miles. The rearrangement of the high-water levees just below Arkansas City since the flood of 1898, and which increased the width of the high-water stream, does not allow a correlation of these figures, although they point, one in a less degree, to the same condition. The very striking curves in the river above Greenville may explain in part these irregularities. A ponding of the waters will take place above the bends. This will allow the waters on the down-stream side of the crest, which are moving faster, to drain off some of the ponded water at a time when there is danger of disastrous results. Thus the slope below the accumulating flood-wave will be a lessening one. At the same time the back slope will also be decreasing because of the increasing height of the crest, and the ponding will go on less and less slowly. However, there will be a too great disparity of level between the upper back slope stage and the lower down slope stage. In this lies the danger of a cut-off. The retardation of the flood-wave by the bends allows a draining of the down-stream side of the crest; if, then, the accumulation of waters above the bends is not far in excess of average flood conditions, the

crest at Greenville will be lower than the normal decrease expectable from the down-river progress in a straight reach of the stream. This lower crest may be attained almost simultaneously with the higher wave up stream.

The ponding of the waters on the up-stream side of the bends precipitates the cut off in a stream's natural development. If a cut-off occurs the disparity of water-levels above and below the neck, yielding an increase of slope, accelerates the movement of the wave-crest. This sudden jump forward of the wave-crest nullifies the effect of the back slope for a time, and tends to ameliorate the flood conditions up stream. As the crest height below the bends may be attained almost simultaneously with the higher wave above, the result of a cut-off is to increase the normal height of the crest below the bends, which, being in some wise the resultant of two crests, and being also some fifteen to twenty-five miles farther down the river, gives good reason for apprehension on the down-stream side. In the Devil's Elbow cut-off, in 1876, these conditions were marked. The present levee system, now about 70 per cent. completed, is constructed to restrain a flood flowing in a given, very irregular channel. Untiring efforts are being expended to keep the channel unchanging. The engineers are forever talking about a cut-off destroying the regimen of the river. There can be no doubt but that a cut-off will turn the force of the current against banks now experiencing little scour, and will deposit sand in places, perhaps, where the levee is constructed to withstand the force of a flood-wave. To prevent the invalidation of a part of their work, the increasing vigilance and outlay over other portions of the levee system, and, above all, the lottery of new conditions, every effort is being made to prevent a cut-off. At Ashbrook Neck, between Arkansas City and Greenville, where in the natural scour of the river 2,000 feet out of 4,500 was removed in thirteen years, and, had not man interfered, at the above rate a cut-off would have been precipitated a few years ago, the most uncertain conditions exist. During the excessive floods the water overflows this point and the points directly below. The question arises whether or not a cut-off can be averted at this point.

The flood season is the working day of the river, It is then that the great bulk of sediment is carried and that much of the work of corrasion is done. The deposit of the materials held in suspension by a flooded stream, if deposited in the bed, is liable to be a detriment to low-water navigation. The formation of a channel, fitted for navigation, depends upon the rate of decline from a high-water to a

low-water stage. A slow, gradual decline is beneficial. The River Commission states in regard to the low-water condition of 1903 that "at the beginning of the season it was expected that the high water of the spring of 1903 would result in the formation of many obstruction bars, and that conditions requiring extensive dredging operations would early develop." "The river did not reach a stage requiring extensive dredging until (nearly the close of the season, on) about December 5." In contrast to this the following fall, 1904, "the dredging season covered the period from August 22 until December 31. . . . Low stages were reached early in the season, and lasted until quite late." The hydrographs of the two seasons show a gradual decline of the flood during the summer of 1903 and a more sudden decline during the same season of 1904. On August 22, when dredging began in 1904, the river had fallen at Vicksburg 23 feet since July 24, or from 54 feet to 31 (Natchez datum), while during the same time during 1903 it fell but 2 feet, from 41 to 39, and it did not reach the 31-foot mark, the dredging-point of 1904, until November 25. Thus, it seems that the low-water channels are not so much affected by the height of the floods of the previous season as by the rate of decline of high water. This rate is influenced by the floods of the lesser tributaries. The second part of the paper discussed the efficiency of the levee system.

GEOGRAPHICAL RECORD.

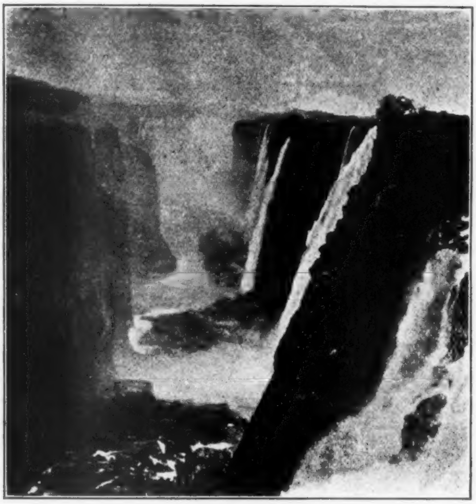
MIKKELSEN'S ARCTIC EXPEDITION.—Captain Ejnar Mikkelsen, of Denmark, a member of Amdrup's expedition to East Greenland, and who has also seen service in Franz Josef Land and on the Greenland west coast, has completed his plans for the exploration of the Beaufort Sea to the north of Alaska. This part of the ocean between the Parry Archipelago and the New Siberia Islands, to the north of the track of the *Jeannette's* drift, is now the largest unknown area of the Arctic. Mikkelsen will enter this region because of his belief (which is shared by some of the leading authorities) that the movement of currents and tides, as well as other facts, point to the probability that there is still undiscovered land in this part of the Arctic.

His enterprise has received substantial support from the Royal Geographical Society and the American Geographical Society. The explorer had collected from various sources abroad all the funds that were thought to be necessary; but when he reached New York, early in February, it was found that he could not depend upon a whaling vessel to reach his destination, as nearly the entire San Francisco fleet is frozen in the ice off the north coast of Alaska. The American Geographical Society has supplied the funds needed to purchase the vessel required.

Having his own vessel, Capt. Mikkelsen will be able to make hydrographical

researches near Bering Strait on his way to Cape Nelson or Cape Kellett on the west coast of Banks Land, where his small party will spend next winter. He hopes to be able to transfer several tons of provisions north to Cape Prince Alfred. He expects to spend 1907 in Banks Land and in Wollaston Land (where he will study the Eskimos who have as yet scarcely met the whites) and hopes also to make a trip to Prince Patrick Island to outline the still unexplored coast. He will procure sledges and dogs from the Eskimos, and early in the spring of 1908 the party will advance to the northern depot and start west over the sea, with thirty dogs, one pony, and provisions for about 132 days. Sounding apparatus will be carried, and it is not the purpose to get north of the continental shelf, as there is every reason to believe that no Arctic land rises from deep waters. The party will endeavour to follow a west-north-west direction to about 76° 30′ N. Lat. and 147° W. Long., and then return southward to Alaska or Wrangel Land. If land is found, only a rough survey will be made of it, and the party will return to organize a more effective expedition.

THE CHASM OF THE VICTORIA FALLS OF THE ZAMBEZI.—This interesting photograph of the chasm of the Victoria Falls was taken by Dr. H. R. Mill, and is published in the January number of *Symons's Meteorological Magazine,* of



CHASM OF THE ZAMBEZI.

which he is the editor. It is the first photograph we have seen of this remarkable chasm. The picture shows the river at a very low stage of water, towards the end of the dry season on Sept. 12, 1905. "In the wet season," writes Dr. Mill, "the enormous volume of water would make it impossible to obtain such a view on account of spray, or to reach the standpoint from which it was taken. The chasm is 400 feet deep and a mile long." The entire river pours over the brink into the chasm and emerges from it through a narrow outlet into the gorge, which extends about 40 miles.

THE EVOLUTION OF SPECIES THROUGH CLIMATIC CONDITIONS.—In *Science* for November 24, 1905, J. A. Allen discusses the evolution of species through climate, in connection with a recent paper (*Science*, Nov. 3, 1905) by President Jordan. In the northern hemisphere most types of birds and mammals of northern origin show a gradual decrease in size from the north to the south in representatives of a conspecific group. This is most marked in the case of birds, in the non-migratory or partly migratory species. The most southern representatives are a fifth to a third smaller than the most northern representatives of the same groups. At the same time, although less generally, there is a relative increase in certain peripheral parts. Secondly, there is a change in coloration, a general restriction in area of white markings, and an increase in area of dark markings, as well as an increase in intensity of colour in areas of tints other than black or white—*e. g.*, yellows, browns, greens, etc., and also in iridescence. In low latitudes, high mountains represent the conditions of higher latitudes nearer sea-level. Grays, browns, and olives are found in regions of heavy rainfall, while pale tints accompany desert areas. Further, regional areas having peculiar climatic conditions show distinctive coloration of their animal inhabitants; in some instances new specific types develop.

In eastern North America, variations in size from north to south are gradual, corresponding with the gradual transition in climatic conditions. The same is true of the gradations in passing westward from the Atlantic to the Pacific and north to Alaska. Topographic conditions do bring about abrupt changes in climate at some points in the latter case, but, in general, the spread of the species is continuous. On the Pacific coast, from Lower California to the Aleutian Islands, there are nine recognized forms of song sparrows, gradually merging, the one into the other, there being no abrupt climatic or geographic barrier anywhere. If some of the intermediate forms were dropped out, the remaining ones might easily be taken for distinct species. Mammals, being sedentary, are even more susceptible than birds to climatic modifications. "In general—in birds and mammals, in which regional modifications are so potent—the main factor is climate, the action general, and the transitions between regions gradual."

R. DEC. W.

CONCLUSIONS OF THE LIGHTNING RESEARCH COMMITTEE.—A Committee organized by the Royal Institute of British Architects and the Surveyors' Institution, and including a representative from the Royal Meteorological Society, has made a report embodying the following practical suggestions:

1. Two main lightning rods, one on each side, should be provided, extending from the top of each tower, spire, or high chimney stack by the most direct course to earth.

2. Horizontal conductors should connect all the vertical rods (*a*) along the ridge, or any other suitable position on the roof; (*b*) at or near the ground-line.

3. The upper horizontal conductor should be fitted with aigrettes, or points, at intervals of 20 or 30 feet.

4. Short vertical rods should be erected along minor pinnacles, and connected with the upper horizontal conductor.

5. All roof metals, such as finials, ridging, rain-water and ventilating pipes, metal cowls, lead flashing, gutters, etc., should be connected to the horizontal conductors.

6. All large masses of metal in the building should be connected to earth either directly or by means of the lower horizontal conductor.

7. Where roofs are partially or wholly metal-lined, they should be connected to earth by means of vertical rods at several points.

8. Gas-pipes should be kept as far away as possible from the positions occupied by lightning-conductors, and, as an additional protection, the service mains to the gas-meter should be metallically connected with house services leading from the meter. R. DEC. W.

FORMATION OF NATURAL BRIDGES.—It is commonly believed that natural bridges, of which the Natural Bridge of Virginia is the best-known American example, are due to the falling in of cavern roofs, leaving only a part to span the stream which the destruction of the cavern has brought to the surface. By a study of the North Adams Natural Bridge, Professor Cleland has been led to the conclusion that in this case, at least, the origin is quite different. In this case the bridge seems to be due to the solution of the limestone along a joint plane near the former course of Hudson brook. At first only a small amount of water seeped along the joint plane, but after awhile it made a channel large enough to divert the entire brook under the surface, giving rise to the bridge. Walcott had previously offered a similar theory for the Natural Bridge of Virginia, and Cleland concludes that, while the falling in of cavern roofs may occasionally give rise to natural bridges, the most common cause for such bridges in marble, limestone, sandstone, and lava is that outlined above. R. S. T.

NOTES.

PROFESSOR ALBRECHT PENCK, of Vienna, has accepted the Professorship of Geography in the University of Berlin, left vacant by the death of Professor von Richthofen.

The *Revue de Géographie,* long published by Delagrave of Paris as a monthly, will hereafter appear as an annual review.

The *American Geologist,* which began publication in 1888, was consolidated on January 1st with the new journal *Economic Geology,* published at Lancaster, Pa. Professor Winchell, the editor, says that he relinquishes this scientific service owing to his desire, with advancing years, to find time for other contemplated work. The *American Geologist,* in the eighteen years of its existence, has certainly contributed its part to geological research and to improvements in the methods of geological work. It has been a monthly journal, but the new publication will appear semi-quarterly.

AS ANNOUNCED IN THE BULLETIN FOR 1905 (page 677), the Tenth International Geological Congress will meet on the 6th of September next in the City of Mexico.

Circular No. 2, issued by the Committee on Organization, presents a programme of excursions before the meeting of the Congress: one of 4 days, limited to 250 persons; one of 8 days, limited to 40 persons; one of 14 days, and one of 7 days, limited to 30 persons.

Four short excursions will be made during the session; and after the close of the Congress there will be two excursions, one of 20 days, limited to 250 persons, and one of 7 or 8 days, limited to 60 persons.

The cost of the excursions will be 20 francs a day for each person, and the price of passage by steamer and railway lines will be reduced 50 per cent.

Membership in the Congress (including a copy of the Report) is to be

obtained by payment of 20 francs (8 Mexican dollars) to the Treasurer of the Committee on Organization, Mr. Juan D. Villarello, 5a del Ciprés No. 2728, Mexico, D. F.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS.—A communication from the Geographical Society of Geneva, Switzerland, announces that the Ninth International Congress will be held in that city from July 27 to August 6, 1908.

A preliminary programme, together with a circular invitation, will be issued during the present year by the Committee on Organization.

BULLETIN OF THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA.—This publication will hereafter be issued quarterly. The January number, in the high quality of its contents and its fine typographical appearance, maintains the reputation of the Society. The contents include a discussion of the Arctic drift-cask experiment by Rear-Admiral Melville and Henry G. Bryant, President of the Society; the first of a series of articles dealing with the regional and economic geography of Pennsylvania, by Walter S. Tower; a Survey, by Prof. R. DeC. Ward of Harvard, of some of the relations between weather and climate and a few of the more important diseases; a description of two geographical excursions by the Society from the pen of Mary S. Holmes; a short sketch of the life-work of the late Baron von Richthofen, and a list of recent accessions to the library. The Publication Committee which has the *Bulletin* in charge is composed of Prof. Emory R. Johnson, chairman, Laura Bell, Henry G. Bryant, and Walter Sheldon Tower.

THE ROYAL BOHEMIAN SCIENTIFIC SOCIETY, of Prague, announces the death on the 19th of January of its former Vice-President, Privy-Councillor KARL RITTER VON KORISTKA, in the 81st year of his age.

U. S. BOARD ON GEOGRAPHIC NAMES.—Decisions January 3, and February 7, 1906:

ALATNA: River, northern Alaska; large branch of Koyukuk River from the northwest. (Not Ah-lash-ok, Alashuk, Al-lash-ook, Allatna, Allen, Allenkakat, nor Oklashok.)

CHEAHA: Mountain, Clay County, Alabama. (Not Blue, Che-aw-ha, Chehaw, Che-haw-haw, nor Shinbone.)

GALOP: Island in the St. Lawrence River, St. Lawrence County, New York. (Not Gallop, Galloup, Galoup, Ile aux Galops, Isle au Gallop, nor Isle au Galop.)

JOHN: River, northern Alaska; tributary to Koyukuk River from the north near longitude 152°. (Not Alchickna, Ascheeshna, Fickett, nor Totsenbetna.)

KITTATINNY: Mountains, New Jersey and Pennsylvania. (Not Blue nor Kitatinny.)

*LINK: River connecting Upper and Lower Klamath Lakes, Oregon. (Not Klamath.)

MITYLENE: City and Island, Turkey. (Not Metelin, Mytilene, nor Mytilini.)

POROPOTANK: Creek, between King and Queen County and Gloucester County, Virginia. (Not Potopotank.)

PRATT CITY: Postoffice, railroad station, and town, Jefferson County, Alabama. (Not Pratt Mines.)

SHOSHONE: Indian Reservation, Fremont County, Wyoming. (Not Wind River.)

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* Reversal of former decision.

SPOTTSYLVANIA: County and courthouse, Virginia. (Not Spotsylvania.)

STOREY: Island, Prince William Sound, Alaska; just north of Naked Island. (Not Little Naked nor Story.)

STOREY: Slough; one of the outlets of the Copper River, Copper River delta, Alaska. (Not Story.)

WESKEAG: River, South Thomaston town, Knox County, Maine. (Not Gig, Keag, Wessawaskeag, Wessaweskeag, nor Westkeag.)

WILD: River, northern Alaska; a large affluent on the north side of Koyukuk River, near longitude 151° 30'. (Not Hokotena, Totsenbet, Totsenbetna, Totzunbetna, nor Totzunbitna.)

BIG FLATS: Town, Chemung County, New York. (Not Bigflats.)

BLOCTON: Town, Bibb County, Alabama. (Not Blockton.)

GORHAM: Mountain, Mt. Desert Island, Hancock County, Maine.

ICICLE: Stream emptying into Wenatchee River, near Leavenworth, Chelan County, Washington. (Not Nacicle.)

IGNACIO: Lakes west of Animas Canyon, La Plata County, Colo. (Not Bishop, Columbine, Mamor, Molar, Pierce, Rockwood Lakes, nor Cascade Reservoir.)

KATALLA: Bay, river, slough, and town, Alaska, near Controller Bay, Gulf of Alaska. (Not Catalla nor Catella.)

NAVAJO: County, creek, reservation, spring, town, and valley, Navajo County, Arizona. (Not Navaho nor Navajoe.)

UINTA: County, mountains, reservation, river, town, and valley, Uinta County, Utah. (Not Uintah.)

WETUMPKA: City and precinct, Elmore County, Alabama. (Not Wetumka.)

AMERICAN GEOGRAPHICAL SOCIETY—TRANSACTIONS FOR DECEMBER AND JANUARY.—On the 21st of December, 1905, the Council by unanimous vote awarded the Cullum Geographical Medal to Captain Robert F. Scott, R. N., for the Voyage of the ship Discovery and his sledge journey to latitude 82° 17' S.

Transactions of the Society, January 5, 1906.—A Regular Meeting was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Friday, January 5, 1906.

Mr. Charles S. Fairchild in the chair.

The following persons, recommended by the Council, were elected Fellows:

Samuel T. Armstrong.	Jed Frye.
A. F. Estabrook.	Frederick R. Franke.
J. G. Battelle.	Henry J. Gielow.
Charles S. Butler.	Robert R. Hollister.
André Champollion.	John H. Bennett.
Edward Russell Coffin.	George H. Smith.
Thomas H. Curtis.	James H. Hickey.
John F. Brooks.	John A. Hadden, Jr.
Frank M. Cronise.	Gurden B. Wallace.
H. G. Dalton.	V. Clement Jenkins.
Francis C. Green.	C. Ledyard Blair.
Thomas Powell Fowler.	LeRoy Harvey.
G. Stanton Floyd-Jones.	

The Chairman then introduced Dr. Otto Nordenskjöld, Commander of the Swedish Antarctic Expedition, who described the events of Two Years in the Ice of the South Pole.

Stereopticon views were shown.

On motion, the Society adjourned.

The Annual Meeting of the American Geographical Society was held at Mendelssohn Hall, No. 119, West Fortieth Street, on Tuesday, January 30, 1906, at 8.30 o'clock, P. M.

Mr. A. A. Raven in the chair.

The following persons, recommended by the Council, were elected:

Honorary Member—William M. Davis, Professor of Geology in Harvard University.

Fellows:

Arthur B. Lovejoy.
Richard P. Hart.
Stuart F. Randolph.
Mansfield Ferry.
A. Duane Doty.
Richard Billings.
James A. Garland.
Charles Landon Jones.
J. de F. Junkin, Jr.
Eugene Limedorfer.
William R. Moody.
Robert Lewis McKnight.
William E. Merrill.
Benjamin A. Morton.
William Houston Kenyon.
August Kuhn.
G. L. Kittredge.
W. J. Denholm.
Daniel S. Knowlton.
David H. Lyon.
Gustave Loeb.
Alexander McDonald.
W. K. Jewett.
Deming Jarves.
A. I. Moxham.
William F. O'Callaghan.
Lewis R. Morris.
Charles Oakes.
Henry F. Owsley.

The Annual Report of the Council was then submitted and read:

NEW YORK, January 18, 1906.

To the American Geographical Society:

The Council respectfully submit the following report for the year 1905:

The number of Fellows on the 1st of January was 1,265. The additions during the year were 178. The losses by death, resignation, etc., were 88, and the total Fellowship on the 31st of December was 1,355, of which number 368 were Life Fellows.

The additions to the Library number 4,594: Periodicals and Pamphlets, 3,588; Books, 637; Maps and Charts, 356; Atlases, 13.

Five Regular Meetings of the Society were held:

On the 24th of January President Peary addressed the Society on the Geographical Work of the World in 1904;

On the 21st of February Mr. Adolphe F. Bandelier described the Region of Lake Titicaca;

On the 28th of March Mr. Harlan I. Smith gave an account of Recent Archæological Discoveries in North Western America;

On the 18th of April Prof. E. L. Stevenson addressed the Society on the World as seen through the eyes of Mediæval Map-makers;

On the 28th of November Mr. Bailey Willis related his Experiences among the Chinese.

There have been published in the BULLETIN, besides the Record, the Scientific Notes and the Book Reviews, thirty-one original papers.

For the condition of the finances reference is respectfully made to the report of the Treasurer, herewith presented.

Rooms in the Society's house have been placed at the disposal of the Geography Teachers' Association and the Association of American Geographers for their meetings.

All of which is respectfully submitted.

HENRY PARISH, *Chairman.*

LEVI HOLBROOK, *Secretary.*

The report of the Treasurer was then read:

Report of the Treasurer to the American Geographical Society for the year 1905:

GENERAL ACCOUNT.

The Treasurer respectfully reports:

On January 1, 1905, there was on hand a cash balance of		$2,600.71
During the year there have been received for Fellowship Dues, Sales of Publications, Interest on Investments, etc.		$22,598.01
		$25,198.72
There have been expended for Salaries, Meetings, Library, Publications, House Expenses, Insurance, Postage, etc.	$19,806.10	
Contribution to Peary's Arctic Expedition	1,000.00	
Invested in Mortgage	900.00	$21,706.10
On December 30th there was on hand a cash balance of		$3,492.62

Respectfully submitted,

WALTER R. T. JONES, *Treasurer.*

The Committee charged with the duty of selecting candidates for the offices to be filled made the following report:

NEW YORK, January 18, 1906.

To the Council of the American Geographical Society:

The Committee appointed to recommend to the Society suitable persons to be elected in January, 1906, to fill vacancies then existing in its offices, respectfully report that they recommend the election of the following-named persons to the offices below designated:

President..............Robert E. Peary (Term to expire in 1907).
Vice-President........William H. H. Moore (Term to expire in 1909).
Treasurer.............Walter R. T. Jones (Term to expire in 1907).
Foreign Corresponding Secretary.........William Libbey (Term to expire in 1909).

Councillors.........Francis M. Bacon, John Greenough, S. Nicholson Kane, M. Taylor Pyne, J. Hampden Robb. (Terms to expire in 1909).

Henry Parish,
L. Holbrook,
A. A. Raven.
Committee.

Mr. C. C. Adams moved that Dr. Ralcy H. Bell be authorized to cast the vote of the Society for the candidates. The motion was seconded; Dr. Bell cast the vote and the candidates were declared duly elected.

The Chairman then read the following:

At the meeting of the Society held at Mendelssohn Hall, November 28, 1905, Mr. F. M. Bacon proposed that the By-Laws be amended as follows:

Amend Chapter I., Section 5, so that it shall read, "The name of any Fellow or Member of the Society may be dropped from the list by vote of the Council, without reference to the Society."

In accordance with Chapter XIII. of the By-Laws the proposed amendment was referred to the Council for consideration and report.

In Council December 21, 1905, the proposal to amend the By-Laws was considered and it was

Resolved, That the proposed amendment of Section 5, of Chapter I., of the By-Laws is eminently proper and should be adopted by the Society.

Resolved, That the Chairman or Secretary of the Council is requested so to report to the Society at its next meeting.

The Chairman then called for the yeas and nays on the adoption of the amendment and it was unanimously adopted.

Mr. Poultney Bigelow, the speaker of the evening, was introduced. He addressed the Society on An American Panama—some personal notes on Tropical Colonisation as affected by Geographic and Political Conditions. Stereopticon views were shown.

On motion, the Society adjourned.

NEW MAPS.

CANADA.—Resource Map of the Dominion of Canada. Scale, 1:12,000,000, or 197.3 statute miles to an inch (?). By James White, Geographer, Department of the Interior. Ottawa, 1905.

The distribution of agricultural, mineral, and other resources is shown by sprinkling the name of products over the map. This method must needs answer until sufficient information is available for showing approximately the areas of the resources and their distribution. A part of western Nova Scotia is one of the finest apple regions in America. But the word "fruit" stamped on this map gives little idea of the extent and approximate position of the part of the peninsula covered by these orchards. Some of the coal-field areas, however, are indicated, and the positions of the collieries are shown. The map will be helpful to students. A little manual of 20 pages gives the latest economic statistics of the Dominion. If the scale of miles is 197.3 statute miles to an inch, as printed on the map, the natural scale is 1:12,500,000.

LONDON.—Stanford's New Map of the County of London. Scale, 1:15,840, or 4 inches to a statute mile. 20 sheets. London: Edward Stanford, 1905. (Price, in sheets, 15s.)

This clearly-printed and excellent map in colours is a new edition, in which recent important changes have been inserted and the whole map carefully revised. The new edition is thoroughly up to date and will maintain the reputation of this

map of the London County as fully satisfying every need of the public. The parks and open spaces controlled by the London County Council are shown in blue-green, other parks and open spaces in yellow-green, and the main roads are coloured brown. Altitudes in feet are given at frequent intervals.

RUSSIA.—Carte Ethnographique de la Russie d'Europe. Scale, 1:12,500,000, or 197.2 statute miles to an inch. By D. Aitoff. *Annales de Géog.* No. 79. Librairie Armand Colin. Paris, 1906.

A clear and good map in 17 tints showing the distribution of the races in Russia in Europe and in Caucasia. The map is based upon the census of 1897. In the colour legend the colours are arranged in the order of the number of persons speaking each language.

ANDREES ALLGEMEINER HANDATLAS.—In 139 Haupt und 161 Nebenkarten; nebst vollständigem alphabetischem Namenverzeichnis von etwa 240,000 Namen. Fünfte, völlig neubearbeitete und vermehrte Auflage. (Lieferungen 13-18.) Herausgegeben von A. Scobel. Velhagen und Klasing, Leipzig, 1905.

This new edition of Andrees Hand-Atlas will contain 37 more maps than the fourth edition. Thirty-eight plates will be entirely redrawn or now first introduced into the atlas. Among the new features are physical maps of Europe and Africa, a map showing distribution of minerals, geological and economic maps of Central Europe, an entirely new plate of Switzerland, and four more pages of African maps, including a physical map. There will be no addition to the number of the American sheets, but all will be revised. This atlas has been noted both for the superior excellence of its maps and its moderate cost. The edition now being issued will even enhance its standing from the scientific and cartographic standpoints, while its price for the map sheets in Lieferungen is only 28 marks, or about $7. The sheets thus far issued are especially conspicuous for the very large number of place-names printed with perfect clearness even in mountainous regions where brown is the predominating tint; and for the unexcelled methods by which sea-floor contours, soundings, and commercial routes are given. The index will contain about 240,000 names.

BOOK NOTICES.

Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. Kaiserliche Marine, Deutsche Seewarte. 8vo. Berlin, 1905, 2 Band. Pp. 200.

The "*Tabellarische Reiseberichte*" of the German Naval Observatory, of which we now have the second volume, are designed to accomplish three things; I. To give a complete list of the marine meteorological Journals sent in to the Seewarte and relating to long voyages. II. To present sufficient information concerning these voyages to enable any one to determine where each vessel was at a given time; thus persons who are studying some problem in marine meteorology or oceanography can find out for themselves how many German ships were within a certain area at a given time. III. They contain a brief summary of the most important nautical, meteorological, and oceanographical data collected by all the ships in all oceans. This is the unique feature of the publication. The data selected for this summary include the following: Limits of the trade winds; irregularities in the trades; storms; ice and icebergs; marked deflections of the

ocean currents; notable variations in the water temperatures; marine earthquakes; dust storms and other striking phenomena. The advantage of these *Tabellarische Reiseberichte* as compared with other marine publications lies in the fact that we here have original observations, without any reduction or averaging, so that each student can do with them as he pleases. The sole limitation results from the selection of observations of certain kinds only, and from the bounds set by the available size of the publication. The present volume (dated Nov., 1905) contains the results of observations sent in during the year 1904.

R. DEC. W.

In the Heart of the Canadian Rockies. By James Outram. xii and 466 pp. 46 Illustrations, Index and Maps. The Macmillan Company, New York, 1905. (Price, $3.)

Every enthusiastic mountain-climber and lover of the sublime in nature will welcome this book. It deals with the Alpine region of the Canadian Rocky Mountains between 51° and 53° N. Lat., where the only American counterpart of the Alps is found—a region of striking grandeur and of vast areas of glaciers, culminating in the huge Columbia ice-field with an area of about 200 square miles.

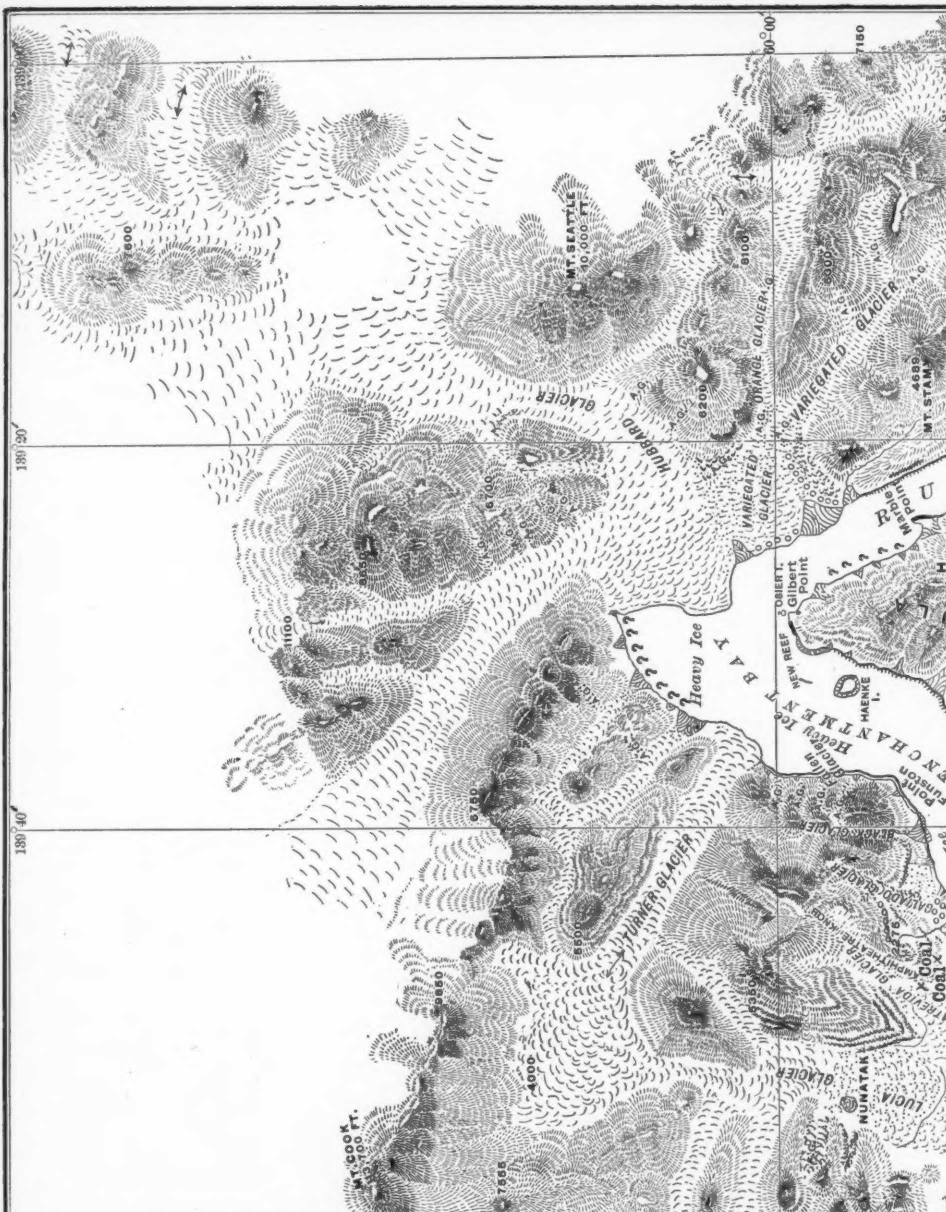
Mr. Outram, during three summers, achieved some of the best ascents that have been made among these mountains. His book will specially appeal to mountain-climbers, but no one can read the story of the grandest of North American mountains and of the trails, lakes, valleys, forests, and fine air among the Canadian Alps without wishing to go there next summer.

Among all these mountains the Selkirks first achieved popularity; but they are described here only briefly in Appendix A, as Mr. A. O. Wheeler has written an exhaustive report on them which is about to be published by the Dominion Land Survey. The photographs give many glimpses of scenic grandeur. A sketch map shows in red the routes traced by mountaineers and explorers, and a very full index enhances the value of the work. Mr. Outram's volume is a desirable addition to the literature, still meagre, of a region that in its geographical and geological aspects and its scenic attractiveness is of great interest both to the man of science and the layman.

A History of the Pacific Northwest. By Joseph Schafer. xvi and 321 pp. Maps and Illustrations. The Macmillan Company, New York, 1905. (Price, $1.25.)

This volume tells, in a simple and readable manner, the story of the great region in the North West known as Oregon in the first half of the nineteenth century, and embracing the present States of Oregon, Washington, and Idaho. Very little space is given to such political phases as the organization and operation of the new State governments; but the unfolding processes by which the wilderness was tamed, homes were multiplied, cities built, and the Pacific North West was linked by commercial routes with all the world are the fascinating theme of the book.

This is a chapter in our history of intense human interest; and the author gives it additional charm by showing how this great civilization has developed under the special physical conditions prevailing there. He devotes fourteen chapters to the early part of this evolutionary period, and the remaining five chapters are practically a sketch of progress in the Pacific northwest from 1849 to the present time. An admirable index makes all the information accessible. The book is well illustrated.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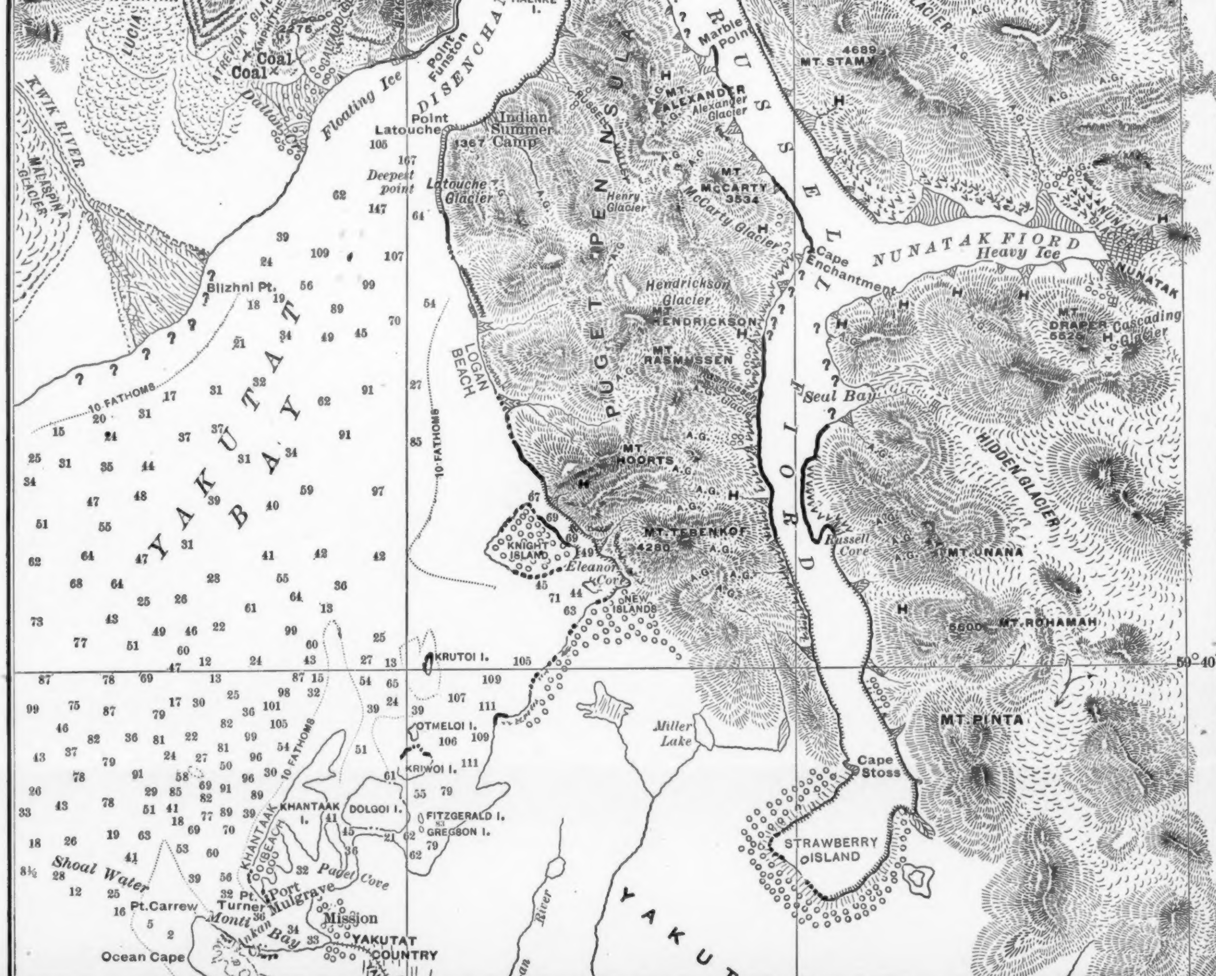
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Cascading Glacier
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Russell Cove
MT. UNANA
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MT. PINTA
Cape Stoss
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Miller Lake
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Point Funston
Point Latouche
Indian Summer Camp
1367
Latouche Glacier
Deepest point
Floating Ice
Dalton Cr.
Coal
LUCIA
KWIK RIVER
MALASPINA GLACIER
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10 FATHOMS
LOGAN BEACH
KNIGHT ISLAND
Eleanor Cove
NEW ISLANDS
KRUTOI I.
OTMELOI I.
KRIWOI I.
DOLGOI I.
FITZGERALD I.
GREGSON I.
KHANTAAK I.
KHANTAAK BEACH
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Pt. Carrew
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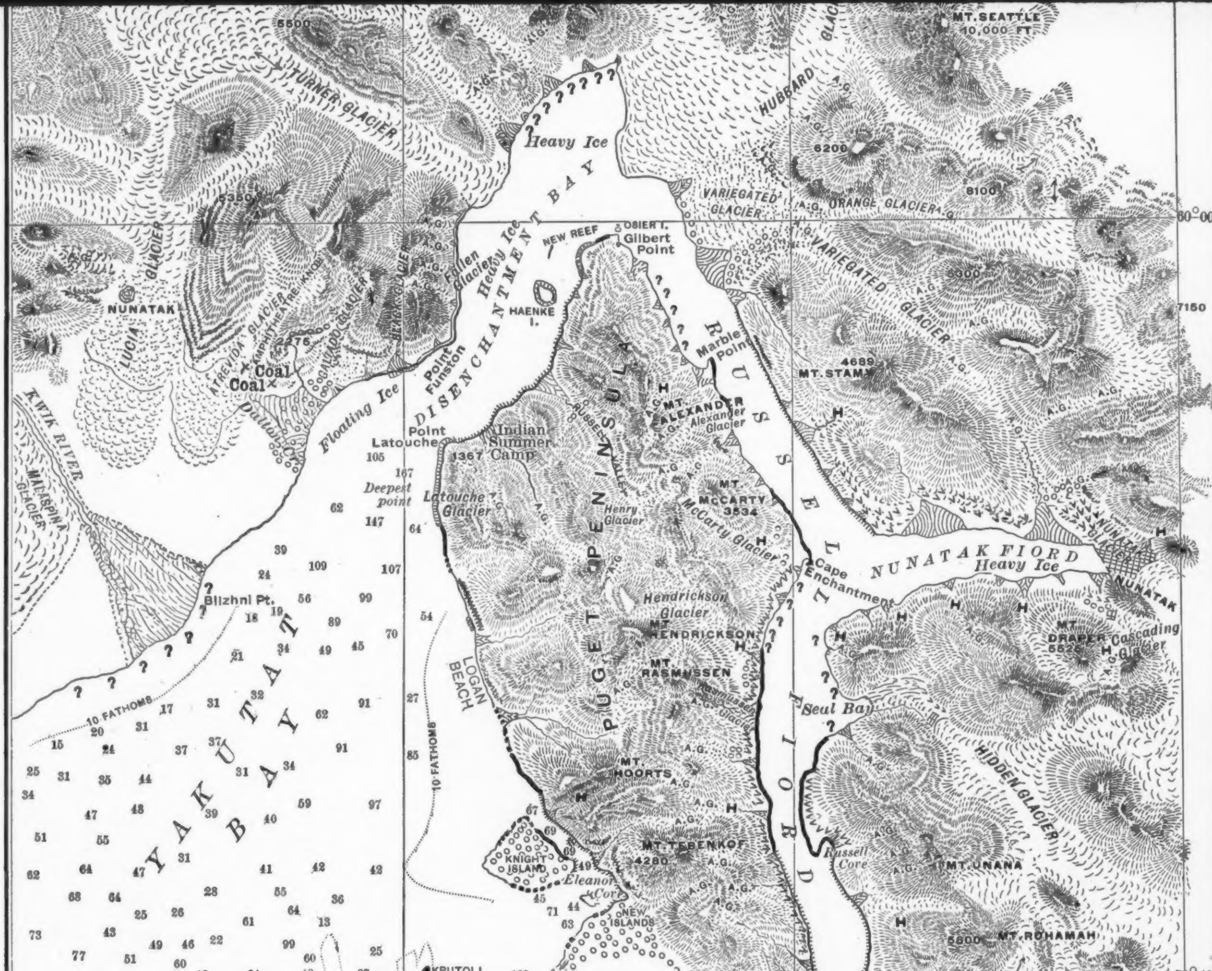
59°40'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LUCIA
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Coal
Point Funston
Floating Ice
KWIK RIVER
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Deepest point
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R U S S E L L F I O R D
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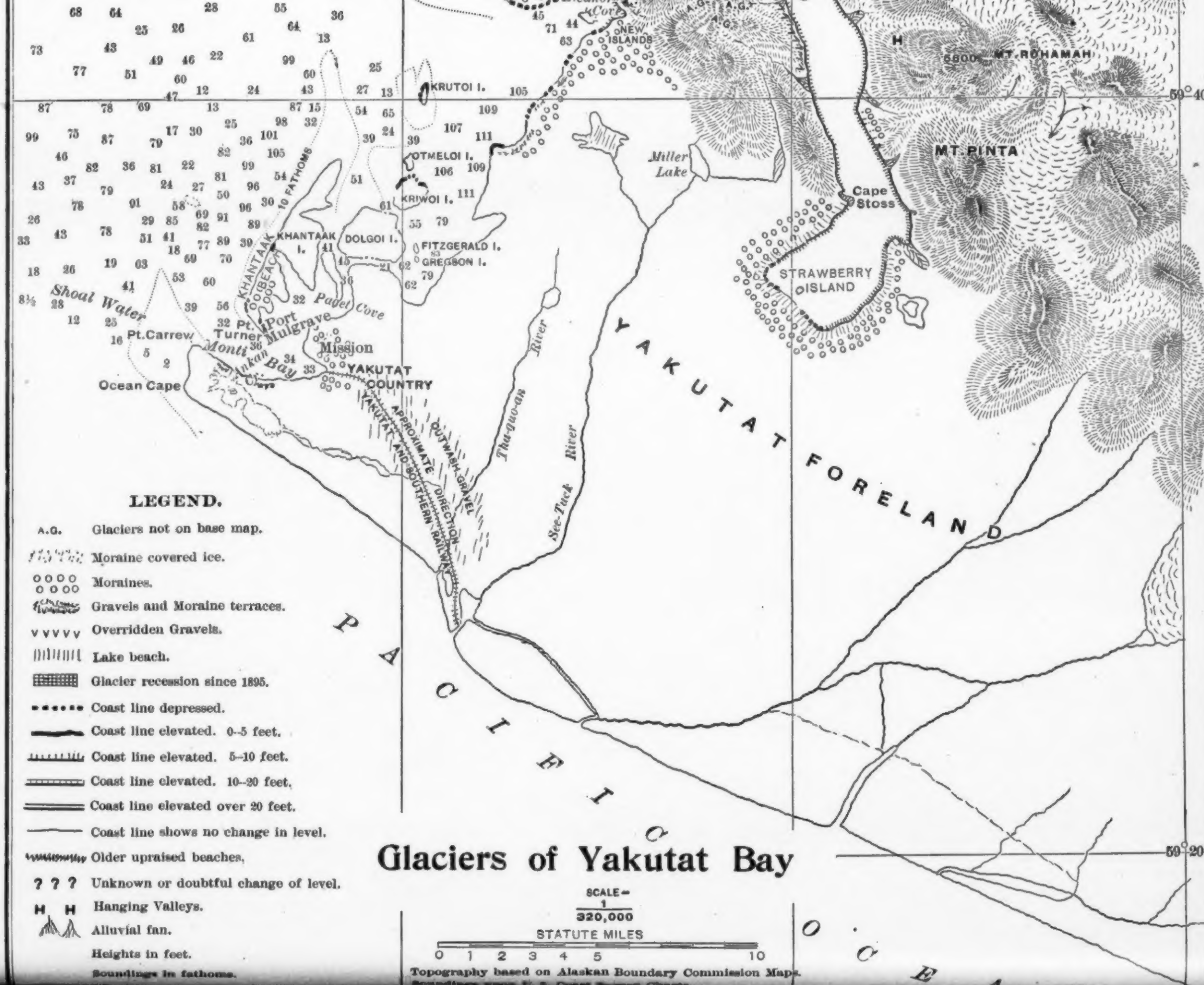

Glaciers of Yakutat Bay
SCALE – 1/320,000
STATUTE MILES
0 1 2 3 4 5 10
Topography based on Alaskan Boundary Commission Maps.
LEGEND.
A.G. Glaciers not on base map.
Moraine covered ice.
Moraines.
Gravels and Moraine terraces.
Overridden Gravels.
Lake beach.
Glacier recession since 1895.
Coast line depressed.
Coast line elevated. 0–5 feet.
Coast line elevated. 5–10 feet.
Coast line elevated. 10–20 feet.
Coast line elevated over 20 feet.
Coast line shows no change in level.
Older upraised beaches.
? ? ? Unknown or doubtful change of level.
H H Hanging Valleys.
Alluvial fan.
Heights in feet.
Soundings in fathoms.
YAKUTAT FORELAND
PACIFIC OCEAN
MT. PINTA
MT. ROHAMAH
5800
Cape Stoss
STRAWBERRY ISLAND
NEW ISLANDS
Miller Lake
KRUTOI I.
OTMELOI I.
KRIWOI I.
DOLGOI I.
FITZGERALD I.
GREGSON I.
KHANTAAK I.
KHANTAAK BEACH
10 FATHOMS
Shoal Water
Pt. Carrew
Pt. Turner
Port Mulgrave
Monti Bay
Ocean Cape
Mission
YAKUTAT COUNTRY
Tha-quo-an River
See-Tuck River
APPROXIMATE DIRECTION
OUTWASH GRAVEL
YAKUTAT AND SOUTHERN RAILWAY
59°40′
59°20′